United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Missouri Agricultural
Experiment Station

Soil Survey of Lincoln County, Missouri

How To Use This Soil Survey

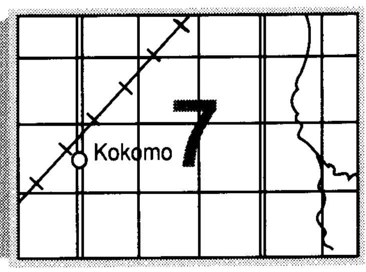
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

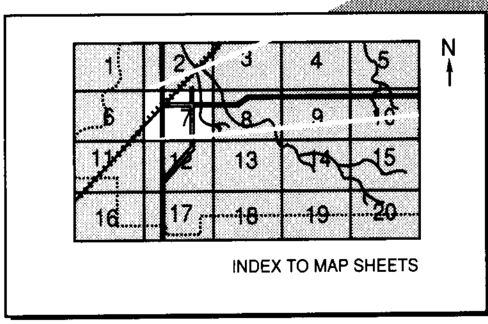
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



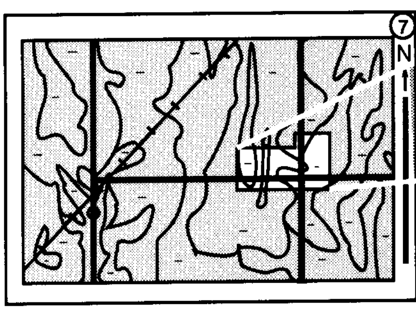
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



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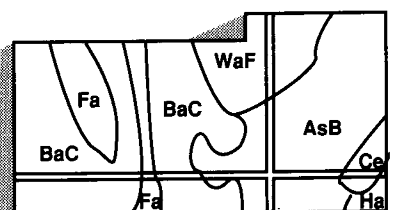

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. The Missouri Department of Natural Resources provided a soil scientist to assist with the fieldwork and with the writing of this report. The survey is part of the technical assistance furnished to the Lincoln County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Beef cattle grazing tall fescue in an area of Crider silt loam, 9 to 14 percent slopes, eroded.

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Foreword

This soil survey contains information that can be used in land-planning programs in Lincoln County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

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State Conservationist
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Soil Survey of Lincoln County, Missouri

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Fieldwork by Richard L. Tummons, Soil Conservation Service, and
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United States Department of Agriculture, Soil Conservation Service,
in cooperation with
the Missouri Agricultural Experiment Station

LINCOLN COUNTY is in the east-central part of Missouri (fig. 1). It has a total area of 409,958 acres, or 640.56 square miles. Troy is the county seat. It is in the south-central part of the county.

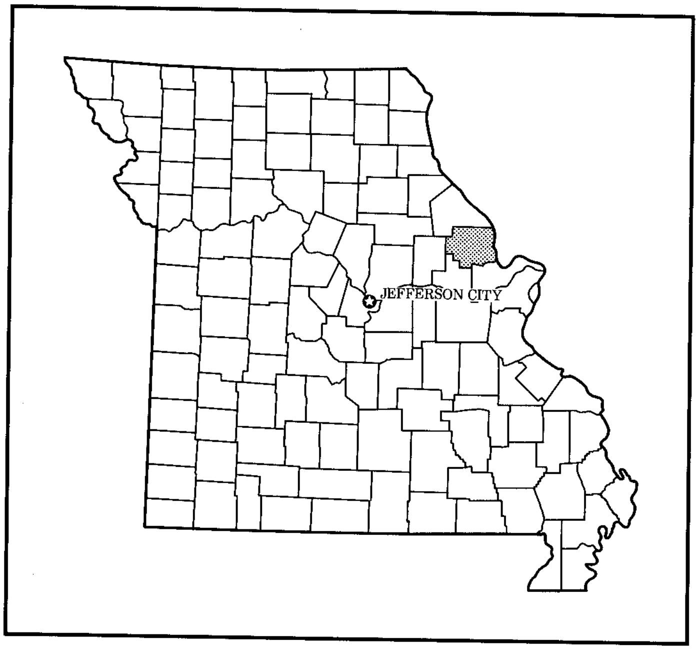

Figure 1.—Location of Lincoln County in Missouri.

Although it is near St. Louis and St. Charles, Lincoln County is dominantly agricultural. Business and industry are slowly moving into the county. Some urban development is taking place along the major highways and thoroughfares.

About 50 percent of the acreage in the county is cropland, 24 percent is pasture, and 26 percent is forest land. About 65 percent of the farm income is derived from cash-grain farming and 35 percent from livestock farming (*7*). Corn, soybeans, wheat, and hay are the principal cash crops. Beef cattle, dairy cattle, hogs, and poultry are the dominant kinds of livestock. Most farm enterprises are a mixture of livestock and cash-grain farming.

This survey updates the soil survey of Lincoln County published in 1920 (*13*). It defines the soil boundaries more clearly and provides more detailed information.

General Nature of the County

This section gives general information concerning the county. It describes climate; natural resources; settlement and population; physiography, relief, and drainage; and transportation facilities and industry.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

The consistent pattern of climate in Lincoln County is one of cold winters and long, hot summers. Heavy rains occur mainly in spring and early in summer, when moist air from the Gulf of Mexico interacts with drier continental air. The annual rainfall is normally adequate for corn, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Elsberry, Missouri, in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 30 degrees F, and the average daily minimum temperature is 20 degrees. The lowest temperature on record, which occurred at Elsberry on January 17, 1977, is -24 degrees. In summer the average temperature is 75 degrees, and the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred at Elsberry on July 15, 1954, is 116 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 36.5 inches. Of this, nearly 23 inches, or about 62 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 17 inches. The heaviest 1-day rainfall during the period of record was 4.35 inches at Elsberry on October 12, 1969. Thunderstorms occur on about 45 days each year. Tornadoes and severe thunderstorms occur occasionally but are local in extent and of short duration. They can cause damage in scattered areas. Hailstorms sometimes occur in scattered small areas during the warmer part of the year.

The average seasonal snowfall is about 18 inches. The greatest snow depth at any one time during the period of record was 17 inches. On the average, 7 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 85 percent. The sun shines 65 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 12 miles per hour, in spring.

Natural Resources

Soil is the most important natural resource in Lincoln County. It provides a growing medium for cultivated crops, pasture species, and timber. Also, some soils are suitable for many urban uses, such as building site development and onsite waste disposal.

Other important natural resources in the county are water and limestone. The county is near the confluence of the Mississippi and Cuivre Rivers. As a result, surface water supplies are abundant. Limestone is quarried in many areas.

Settlement and Population

Many different Indian tribes at one time inhabited the survey area. The Sac, Fox, Osage, and Missourian tribes were among those who claimed the area as their home and hunting grounds. Most left the area after their defeat in the War of 1812.

In 1803, the United States acquired the survey area through the Louisiana Purchase. The influx of Anglo-American settlers, however, had begun several years before because of the encouragement of the Spanish territorial government. Lured by cheap land, more settlers poured into the area. Many were Southerners. Later, in the 1830's small numbers of German and Irish people also settled in the county (*4*).

The population of the county was 9,421 in 1850. Mainly because of the development resulting from the advent of the railroad in the late 1800's, the population increased to 18,352 by 1900 (*8*). It decreased to less than 13,000 during the Depression. By 1980, it had increased to 22,147 because job opportunities increased and because people moved out of the St. Louis area to homes in the county.

Physiography, Relief, and Drainage

Lincoln County has a number of major physiographic regions. The dominant region is one of loess, glacial till, and residual soils in the central part of the county. The western boundary is a prairie region of loess and glacial till. The alluvial flood plains along the Cuivre River and Big Creek dissect both these regions. A band of residual soils borders these flood plains. The flood plains adjacent to the Mississippi River are along the eastern boundary. They are bordered by a loess-covered region.

Bedrock is exposed in the steeper areas of the county and at the lower elevations along drainageways. Bedrock of the Tertiary-Quaternary age underlies the flood plains along the Mississippi River. Most of the uplands are underlain by rock of the Mississippi age. Ordovician bedrock is in the northeast corner of the county.

The lowest elevation in the county is about 420 feet above sea level. It is at the confluence of the Cuivre and Mississippi Rivers. The highest elevation is about 900

feet above sea level. It is in the northeastern part of the county.

Surface water in all of Lincoln County drains into the Mississippi River. The Cuivre River, which is the major tributary, drains the western and central parts of the county. Bryants, Bobs, McLeans, Lost, Hurricane, and Sandy Creeks drain the eastern part. They flow directly into the Mississippi River.

Transportation Facilities and Industry

Lincoln County has good transportation facilities. The major transportation routes are U.S. Highway 61 and State Highways 79 and 47. Interstate 70, a major east-west thoroughfare, is directly south of the county. One railroad and three truck lines serve the county.

The county has a wide variety of businesses and industry, which provide both services and goods. Elevator, feed, fertilizer, implement, and hardware businesses serve the agricultural community. Nonagricultural businesses employ more than 3,700 workers. They manufacture ladies apparel, books, shoe lasts, and vending machines (*11*).

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads,

and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The descriptions, names, and delineations of the soils identified on the general soil map of this county do not fully agree or join with those of the soils identified on the maps of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local variations. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately.

Soil Descriptions

1. Keswick-Hatton Association

Deep, gently sloping to strongly sloping, moderately well drained soils formed in loess and glacial till; on uplands

This association consists of soils on narrow ridgetops and short side slopes dissected by winding, narrow drainageways. It makes up about 29 percent of the county. It is about 51 percent Keswick and similar soils, 32 percent Hatton and similar soils, and 17 percent minor soils (fig. 2).

The Keswick soils are moderately sloping and strongly sloping. They are on ridges and side slopes below the Hatton soils. Typically, the surface layer is dark brown silt loam. The subsoil is mottled clay. It is yellowish red in the upper part and dark brown and strong brown in the lower part. The substratum is yellowish brown, mottled clay loam.

The Hatton soils are gently sloping and moderately sloping. They are on ridges and side slopes above the Keswick soils. Typically, the surface layer is dark brown silt loam. The subsurface layer is yellowish brown silt loam. The subsoil is yellowish brown and dark yellowish brown silty clay in the upper part and yellowish brown, mottled silty clay loam in the lower part.

Minor in this association are the Bucklick, Crider, Goss, Haymond, and Mexico soils. The well drained Bucklick and Crider soils are on the lower ridges and side slopes. Goss soils are cherty throughout. They are on the lower side slopes. Haymond soils are silty throughout. They are on narrow flood plains. The somewhat poorly drained Mexico soils are on the higher, wider ridges.

About 60 percent of the acreage in this association has been cleared of trees. Corn, soybeans, grain sorghum, and wheat commonly are grown on the gently sloping and moderately sloping soils on the broad ridgetops and side slopes. Most of the cleared areas of strongly sloping and moderately steep soils are used for pasture and hay. The raising of livestock is a major enterprise. The uncleared acreage is in the steeper areas. It generally supports mixed hardwoods.

Controlling water erosion and improving or maintaining fertility and tilth are the main concerns in managing the major soils for crops. The erosion caused by overgrazing is the main concern in managing pasture. In most pastured areas ponds have been constructed to provide water for livestock.

The major soils are suitable for trees. The existing timber stands are dominantly oak and hickory. Seedling mortality and the windthrow hazard are moderate.

The major soils are suited to building site development and sanitary facilities. The shrink-swell potential, restricted permeability, wetness, and slope are the main problems. Because of the restricted permeability, the soils generally are unsuited to septic tank absorption fields. They generally are better suited to sewage lagoons.

2. Mexico-Keswick Association

Deep, gently sloping to strongly sloping, somewhat poorly drained and moderately well drained soils formed in loess and in loess and glacial till; on uplands

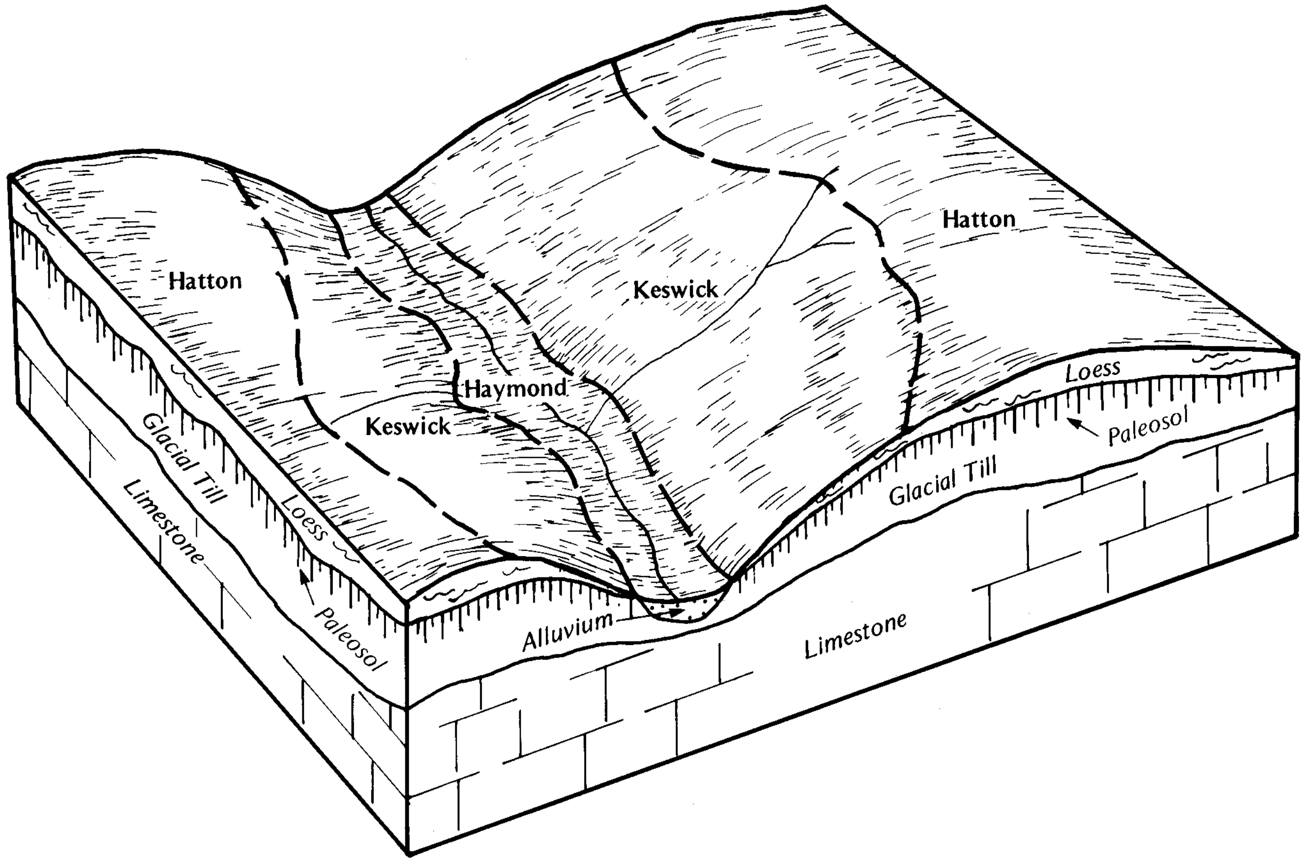

Figure 2.—Typical pattern of soils and parent material in the Keswick-Hatton association.

This association consists of soils on broad ridgetops and short side slopes dissected by the upper ends of small drainageways. It makes up about 22 percent of the county. It is about 50 percent Mexico soils, 31 percent Keswick and similar soils, and 19 percent minor soils (fig. 3).

The Mexico soils are gently sloping and somewhat poorly drained. They are on broad upland divides and on long side slopes. Typically, the surface layer is dark brown silt loam. The subsoil is mottled silty clay. It is dark grayish brown in the upper part and grayish brown in the lower part. The substratum is grayish brown, mottled silty clay.

The Keswick soils are moderately sloping and strongly sloping and are moderately well drained. They are on side slopes below the Mexico soils. Typically, the surface layer is dark brown silt loam. The subsoil is mottled clay. It is yellowish red in the upper part and dark brown and strong brown in the lower part. The substratum is yellowish brown, mottled clay loam.

Minor in this association are the Hatton, Kennebec, Moniteau, Putnam, and Twomile soils. Hatton and Kennebec soils are moderately well drained. Hatton soils are on narrow ridges below the Mexico soils. Kennebec soils are silty throughout. They are on flood plains. Moniteau, Twomile, and Putnam soils are poorly drained. Moniteau and Twomile soils are on stream terraces. The nearly level Putnam soils are on broad ridges.

About 90 percent of the acreage in this association has been cleared of trees. Corn, soybeans, grain sorghum, and wheat commonly are grown on the gently sloping and moderately sloping soils on the ridges. Some of the side slopes are pastured. The raising of livestock is a major enterprise. The uncleared acreage occurs mainly as nearly level soils on terraces and narrow flood plains and as the steeper soils on side slopes. It generally supports mixed hardwoods.

Controlling water erosion, improving or maintaining fertility and tilth, and improving surface drainage are the main concerns in managing the major soils for crops. The erosion caused by overgrazing is the main concern in managing pasture. In most pastured areas ponds have been constructed to provide water for livestock.

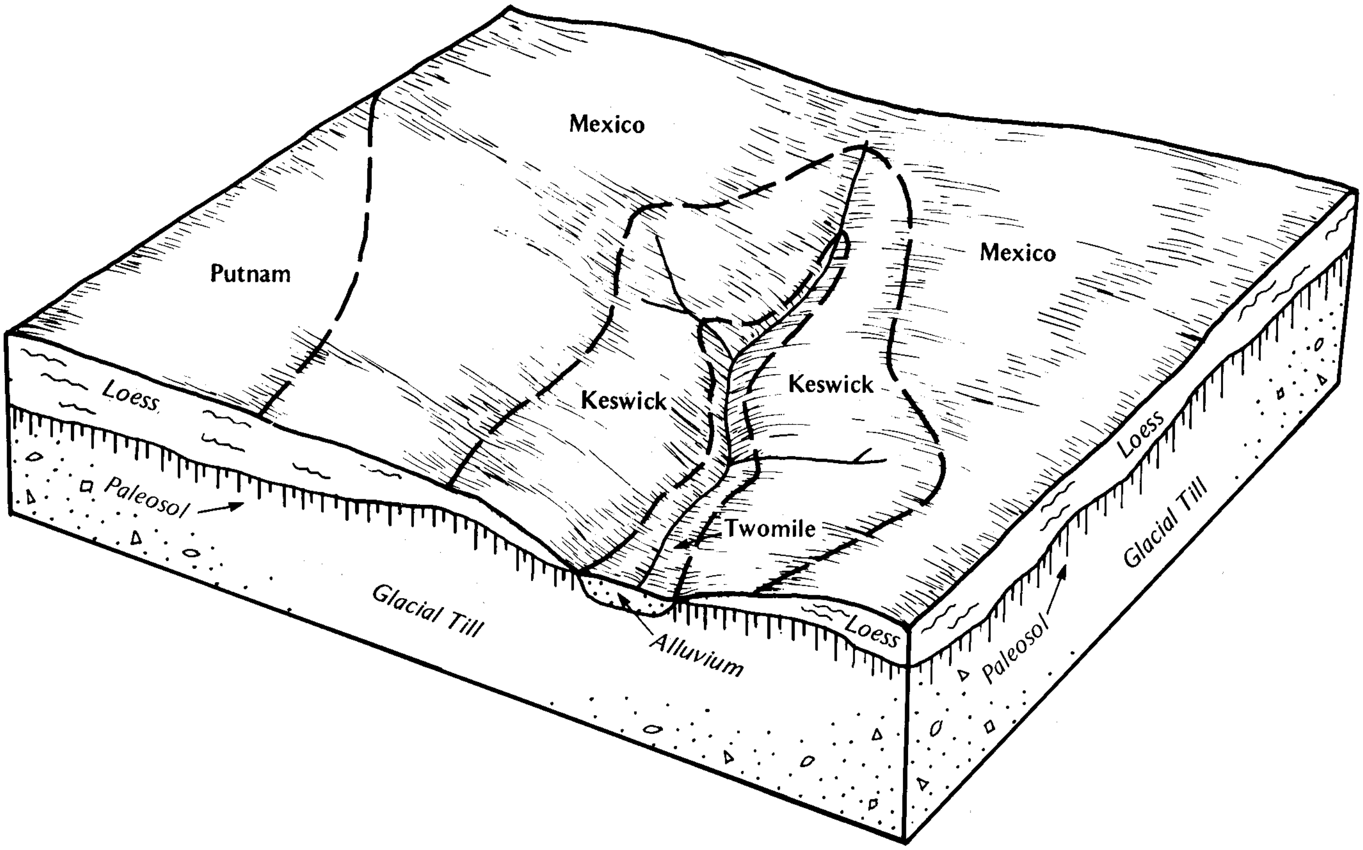

Figure 3.—Typical pattern of soils and parent material in the Mexico-Keswick association.

The major soils are suitable for trees. The existing timber stands are dominantly oak and hickory. Seedling mortality and the windthrow hazard are moderate.

The major soils are suited to building site development and sanitary facilities. The shrink-swell potential, restricted permeability, wetness, and slope are the main problems. Because of the restricted permeability, the soils generally are unsuited to septic tank absorption fields. They generally are better suited to sewage lagoons.

3. Goss-Gasconade-Brussels Association

Deep and shallow, strongly sloping to very steep, well drained and somewhat excessively drained soils formed in cherty dolomite or limestone residuum and in colluvium; on uplands

This association consists of cherty soils on ridgetops; flaggy, shallow soils on the lower side slopes; and flaggy, deep soils on foot slopes. The landscape is highly dissected by narrow, branching drainageways. The differences in elevation between the ridgetops and the flood plains is commonly 250 feet. Valleys are deep and generally are no more than 0.25 mile wide.

This association makes up about 18 percent of the county. It is about 30 percent Goss soils, 20 percent Gasconade soils, 16 percent Brussels soils, and 34 percent minor soils (fig. 4).

The Goss soils are strongly sloping to very steep and are deep. They are well drained and commonly are on ridgetops and the upper side slopes. Typically, the surface layer is dark brown cherty silt loam. The subsurface layer is yellowish brown very cherty silty clay loam. The subsoil is red very cherty silty clay in the upper part and red very cherty clay in the lower part.

The Gasconade soils are strongly sloping to very steep and are shallow. They are somewhat excessively drained and commonly are on side slopes below the Goss soils and above the Brussels soils. Typically, the surface layer is very dark grayish brown very flaggy silty clay loam. The subsoil is very dark grayish brown very flaggy silty clay. Limestone bedrock is at a depth of about 13 inches.

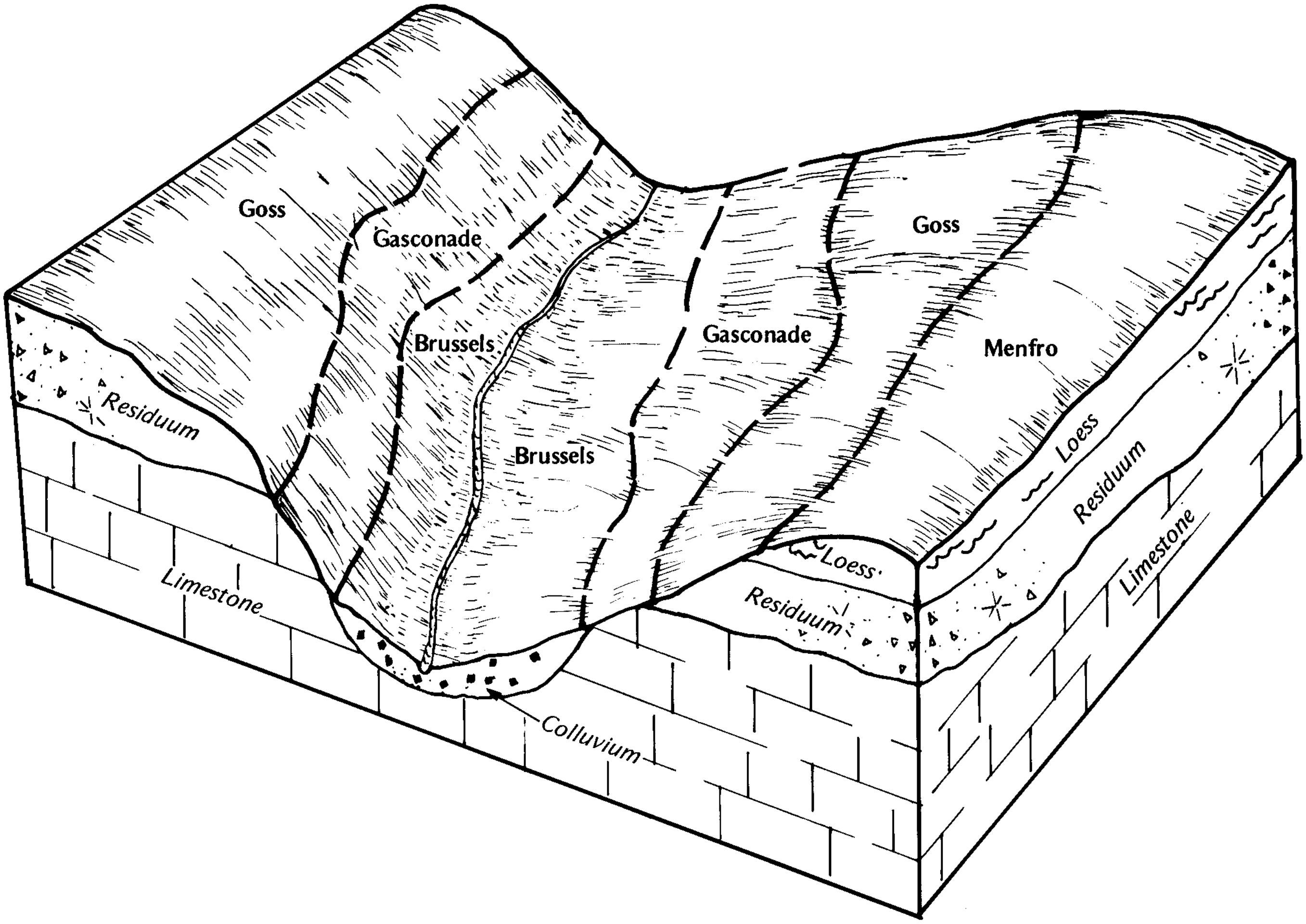

Figure 4.—Typical pattern of soils and parent material in the Goss-Gasconade-Brussels association.

The Brussels soils are moderately steep to very steep and are deep. They are well drained and generally are on the lower side slopes. Typically, the surface layer is black very flaggy silty clay loam. The subsoil is very dark grayish brown and dark brown very flaggy silty clay in the upper part and brown very flaggy silty clay loam in the lower part.

Minor in this association are the Bucklick, Crider, Hatton, Keswick, and Menfro soils. Bucklick, Crider, and Hatton soils have no coarse fragments. Bucklick and Crider soils are on ridgetops, side slopes, and toe slopes. Hatton soils commonly are on ridgetops. Keswick soils have glacial sand and pebbles. They are higher on side slopes than the Goss soils. The well drained Menfro soils are on narrow ridgetops.

Most of the acreage in this association supports native hardwoods, dominantly oak and hickory. Some of the less sloping areas have been cleared of trees. Most cleared areas are on ridgetops, foot slopes, and flood plains. They are used for cultivated crops, hay, or pasture.

The wooded acreage is areas where the soils are too steep or too cherty or flaggy for cultivation. The existing timber stands should be improved. The slope restricts the use of equipment. Erosion, seedling mortality, and windthrow are other management concerns.

The less sloping soils are suitable for pasture and hay. The slope and the hazard of erosion are the main limitations in the areas used for pasture and hay.

The soils in some of the less sloping areas are suited to some sanitary facilities and to low-density building site development. The slope and the content of coarse fragments are the major problems affecting building site development. The shallow depth to bedrock in the Gasconade soils also is a problem.

4. Menfro-Crider Association

Deep, gently sloping to steep, well drained soils formed in loess and in loess and limestone residuum; on uplands

This association consists of soils on the highly dissected hills adjacent to the flood plains along the Mississippi River. It makes up about 13 percent of the county. It is about 62 percent Menfro and similar soils, 30 percent Crider soils, and 8 percent minor soils (fig. 5).

The Menfro soils are gently sloping to steep. They are on ridgetops and convex side slopes. They generally are higher on the landscape than the Crider soils. Typically, the surface layer is dark brown silt loam. The subsoil is dark yellowish brown and brown silty clay loam in the upper part and brown silt loam in the lower part. The substratum is brown silt loam.

The Crider soils are moderately sloping to moderately steep. They are on narrow ridgetops and on convex side slopes below the Menfro soils. Typically, the surface layer is dark brown silt loam. The subsoil is dark brown silt loam and silty clay loam in the upper part and reddish brown silty clay loam in the lower part.

Minor in this association are the Bucklick, Gasconade, Haymond, Ramsey, and Weller soils. Bucklick soils have more clay than the major soils. They are on the lower side slopes. The shallow Gasconade and Ramsey soils are adjacent to deeply dissected drainageways. Haymond soils have less clay throughout than the major soils. They are on narrow flood plains. The gently sloping and moderately sloping Weller soils are on high stream terraces and on side slopes.

Much of the acreage in this association has been cleared of trees and is used for corn, soybeans, grain sorghum, wheat, hay, or pasture. Many beef and hog enterprises and dairy farms are in areas of this association. The uncleared acreage supports mixed hardwoods. It is mainly in steep, uneven areas and in areas of karst topography.

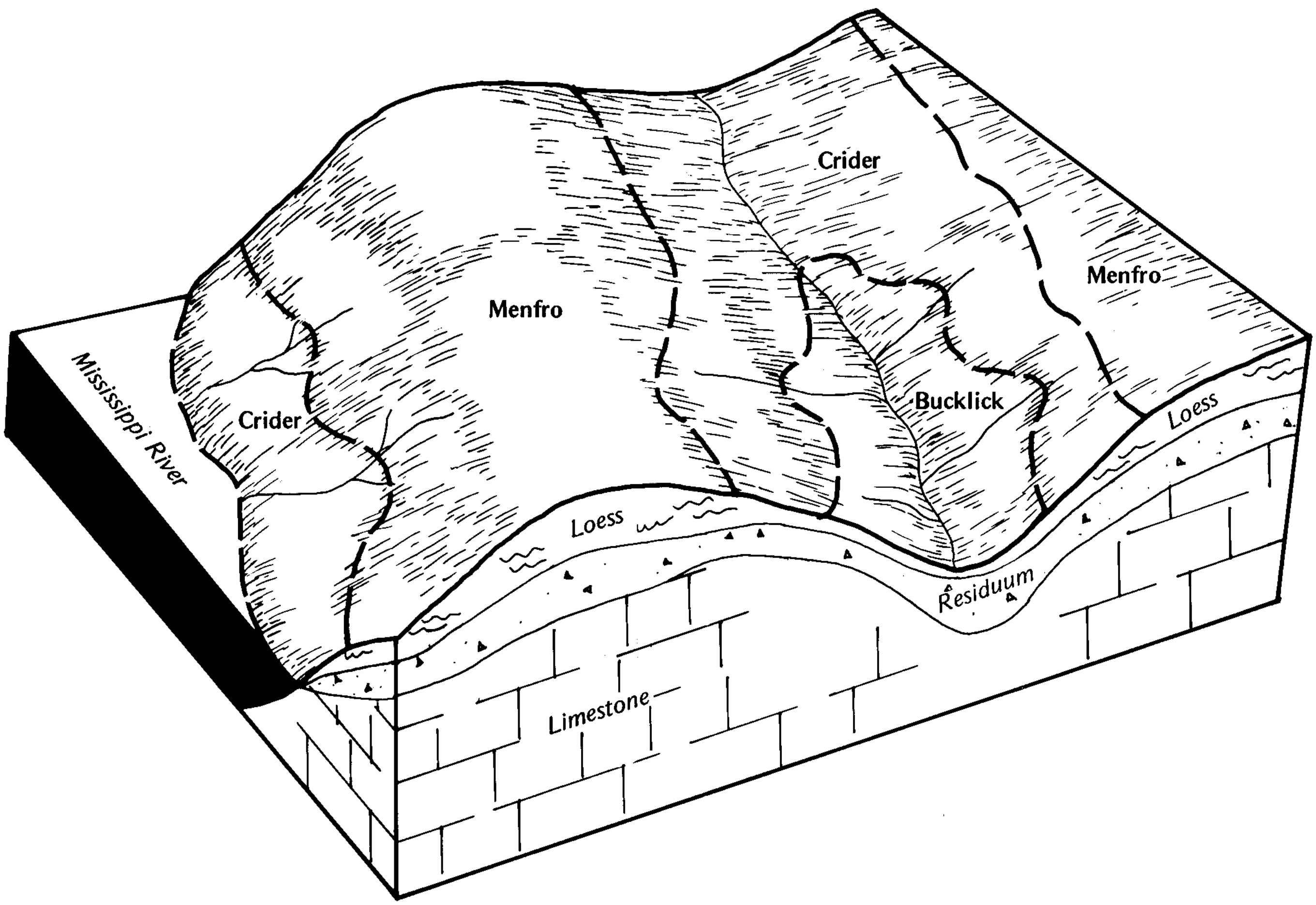

Figure 5.—Typical pattern of soils and parent material in the Menfro-Crider association.

Controlling water erosion and improving or maintaining fertility and tilth are the main concerns in managing the major soils for crops. Also, gully erosion is a major concern in the steeper areas. A cover of pasture plants or hay is effective in controlling erosion. The erosion caused by overgrazing is the main concern in managing pasture. In most pastured areas ponds have been constructed to provide water for livestock.

The major soils are well suited to trees. The well drained soils on uplands also are well suited to orchards and vineyards. The woodland generally is in areas that are too steep or too uneven for farming. The timber stands are dominantly oak and hickory. Measures that improve the stands are needed. Erosion and the equipment limitation are problems on the moderately steep and steep soils.

This association is suited to sanitary facilities and building site development. The major problems affecting building site development are the slope and the shrink-swell potential.

5. Portage-Carlow-Dockery Association

Deep, nearly level, very poorly drained to somewhat poorly drained soils formed in clayey and silty alluvium; on flood plains

This association consists of soils on the broad flood plains along the Mississippi River. Differences among the soils are largely the result of variations in the texture of the parent material. Differences in elevation are slight. In general, the highest elevations are on islands, in areas adjacent to the river channels, and in areas adjacent to the uplands. The lower areas commonly are near the center of the flood plains.

This association makes up about 9 percent of the county. It is about 36 percent Portage soils, 34 percent Carlow soils, 15 percent Dockery soils, and 15 percent minor soils.

The Portage soils are very poorly drained and are in broad depressions. Typically, the surface soil is very dark gray clay. The subsoil is dark gray, mottled clay.

The Carlow soils are poorly drained and are in low areas and on natural levees. Typically, the surface layer is very dark grayish brown silty clay loam. The subsoil is mottled silty clay. It is dark grayish brown in the upper part and grayish brown in the lower part.

The Dockery soils are somewhat poorly drained and are on islands and on natural levees adjacent to the river channels. Typically, the surface layer is very dark gray silty clay loam. The substratum is very dark grayish brown silty clay loam and dark grayish brown silt loam.

Minor in this association are the somewhat poorly drained Dupo and Kampville soils. These soils have more clay in the lower part than the Dockery soils. Dupo soils are adjacent to small streams. Kampville soils are in the slightly higher areas where the flood plains border the uplands.

Most of the acreage in this association is used for corn or soybeans. Many frequently flooded areas near the channel of the Mississippi River are wooded. These areas also are used as shallow water habitat for migratory waterfowl.

The wetness is a major management concern in cultivated areas. A drainage system is needed. The varieties of row crops that require a short growing season generally grow best because of the wetness during the spring and fall.

The major soils are suitable for trees. Cottonwood, black willow, and silver maple are the dominant timber species. The wetness limits the use of equipment. Seedling mortality and windthrow are other management concerns.

This association generally is unsuitable as a site for sanitary facilities and buildings. The wetness, the flooding, and the shrink-swell potential are the major limitations.

6. Haymond-Moniteau Association

Deep, nearly level, well drained and poorly drained soils formed in silty alluvium; on flood plains and stream terraces

This association consists of soils on narrow flood plains and stream terraces. It makes up about 9 percent of the county. It is about 55 percent Haymond soils, 25 percent Moniteau soils, and 20 percent minor soils.

The Haymond soils are well drained. They are adjacent to stream channels and are lower on the landscape than the Moniteau soils. Typically, the surface layer is brown silt loam. The substratum is brown and yellowish brown silt loam.

The Moniteau soils are poorly drained. They are on low terraces along rivers and creeks. Typically, the surface layer is dark grayish brown silt loam. The subsurface layer is grayish brown silt loam. The subsoil is dark grayish brown and grayish brown, mottled silty clay loam.

Minor in this association are the Cedargap, Dameron, Kennebec, and Twomile soils. Cedargap and Dameron soils are on the narrow flood plains along creeks. Cedargap soils have chert throughout, and Dameron soils have chert in the lower part. Kennebec soils are dark throughout. They are in landscape positions similar to those of the Dameron soils. Twomile soils are poorly drained and are on terraces along rivers.

This association is intensively cultivated. Corn, soybeans, and wheat are the main crops. Some areas are used for meadow crops or pasture. Flooding and wetness are the main management concerns.

This association generally is unsuited to sanitary facilities and building site development because of the flooding. Buildings should be constructed above known flood levels.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Menfro silt loam, 5 to 9 percent slopes, eroded, is a phase of the Menfro series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Goss-Gasconade-Brussels complex, 9 to 70 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarries, is an example. Miscellaneous areas are shown on the soil maps.

The descriptions, names, and delineations of the soils identified on the detailed soil maps of this county do not fully agree or join with those of the soils identified on the maps of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local variations. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

2D—Goss silt loam, 9 to 14 percent slopes. This deep, strongly sloping, well drained soil commonly is on the crest of narrow upland ridges, but in some areas it is on side slopes. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark brown silt loam about 4 inches thick. The subsurface layer is yellowish brown very cherty silt loam about 10 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish red, firm very cherty silty clay, and the lower part is red, firm extremely cherty clay. In some areas the surface layer is cherty.

Permeability is moderate, and surface runoff is rapid. The available water capacity is low. The shrink-swell potential is moderate. Natural fertility is low, and the organic matter content is moderately low. The surface layer is difficult to till because of the high content of chert.

Nearly all areas are used as woodland. A few have been cleared and are used as pasture. This soil is suited to trees. In most of the existing timber stands, thinning and selective cutting are needed. New stands should be protected from fire and overgrazing. No other hazards or limitations affect planting or harvesting.

Because of the slope and the high content of chert, this soil is unsuited to cultivated crops. It is moderately well suited to crownvetch, lespedeza, red fescue, and tall fescue. It is moderately suited to alfalfa, ladino clover, and orchardgrass and moderately well suited to big bluestem and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Timely seeding helps to ensure rapid growth of a good plant cover.

This soil is suited to low-density building site development. Dwellings can be designed so that they conform to the natural slope of the land, but land shaping is necessary in some areas. Large stones should be removed from the building sites. Constructing footings and foundations with adequately reinforced concrete helps to prevent the structural damage caused by shrinking and swelling.

This soil is suitable as a site for septic tank absorption fields. The slope, the restricted permeability, and the large stones are limitations. Generally, the site should be shaped and the distribution lines installed across the slope. Enlarging the absorption field helps to overcome the restricted permeability.

If this soil is used as a site for local roads and streets, low strength, frost action, the shrink-swell potential, and the slope are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling. Cutting and filling are needed in some areas.

The land capability classification is VIs. The woodland ordination symbol is 3A.

2F—Goss cherty silt loam, 14 to 50 percent slopes. This deep, moderately steep to very steep, well drained soil is on long, uneven side slopes in the uplands. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is dark brown, very friable cherty silt loam about 7 inches thick. The subsurface layer is yellowish brown, friable very cherty silty clay loam about 9 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is red, firm very cherty silty clay, and the lower part is red, firm very cherty clay. In some areas the surface layer is silt loam. In a few areas the soil is not cherty in the lower part.

Included with this soil in mapping are some areas of soils that are moderately deep over limestone bedrock or shale. These soils are on the lower slopes. Also included are a few areas of Gasconade soils on short, steep slopes along drainageways and a few areas of Brevator soils on the upper side slopes. Brevator soils are nearly chert free. Included areas make up about 5 percent of the unit.

Permeability is moderate in the Goss soil, and surface runoff is rapid. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderately low. The surface layer is very difficult to till because of the high content of chert.

Nearly all areas are used as woodland. Most support native hardwoods. This soil is suited to trees. The stones and droughtiness somewhat limit tree planting. Container-grown planting stock may be needed because of the seedling mortality rate. The slope limits the use of harvesting equipment. Logging roads and skid trails should be constructed on the contour. The logs can be yarded uphill to logging roads and skid trails. In most of the existing stands, thinning and selective cutting are needed. New stands should be protected from fire and overgrazing. Good woodland management improves the habitat for woodland wildlife, especially white-tailed deer and wild turkeys.

This soil is unsuited to cultivated crops and hay because of the slope, the chert, and the droughtiness. A few areas have been cleared and are used as pasture. The soil is moderately suited to crownvetch, lespedeza, red fescue, and tall fescue. It also is moderately suited to switchgrass, indiangrass, and most other warm-season grasses. Erosion during seedbed preparation is the main management problem. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided.

Because of the slope, this soil generally is not suited to building site development or onsite waste disposal. It can be used for low-density urban development if the site is extensively prepared. The cost of such preparation, however, can be prohibitive.

The land capability classification is VIIs. The woodland ordination symbol is 3R.

3—Twomile silt loam. This deep, nearly level, poorly drained soil is on stream terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 5 to 25 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsurface layer is about 22 inches thick. The upper part is brown, friable silt loam, and the lower part is grayish brown, firm, compact and brittle silt. The subsoil to a depth of 60 inches or more is firm silty clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part.

Permeability and surface runoff are slow. The available water capacity is moderate. A perched water table is at a depth of 1 to 2 feet during most winter and spring months. The shrink-swell potential is moderate. Natural fertility is medium, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled. Root development is somewhat restricted by the compact, dense layer below a depth of about 18 inches.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Because of the dense, compact part of the subsurface layer, which restricts water movement, the soil is wet during the winter and spring and droughty during the summer. A surface drainage system is needed. Irrigation is needed during the summer.

This soil is better suited to water-tolerant, shallow-rooted grasses for hay and pasture than to other forage species. It is moderately suited to alsike clover and reed canarygrass. It is poorly suited to crownvetch, ladino clover, tall fescue, and switchgrass. The wetness is the main management problem. The grazing system should accommodate extremely wet periods. A seedbed cannot be easily prepared during these periods. A surface drainage system improves the growth of the deeper rooted species.

This soil is suited to trees. The equipment limitation, seedling mortality, and windthrow are management concerns. Harvesting and planting should be restricted to periods when the soil is dry or frozen. Planting container-grown nursery stock increases the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Because of the wetness and the flooding, this soil generally is not suitable for building site development or onsite waste disposal.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

5C2—Bucklick silty clay loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, well drained soil is on ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is dark brown, friable silty clay loam about 6 inches thick. The subsoil is about 50 inches thick. The upper part is dark brown, firm silty clay loam, and the lower part is yellowish red, firm silty clay. Hard limestone bedrock is at a depth of about 56 inches. Some areas have a karst topography.

Included with this soil in mapping are a few areas of Crider soils on the upper side slopes and a few areas where limestone bedrock crops out on some of the lower slopes. Included areas make up about 10 percent of the unit.

Permeability is moderate in the Bucklick soil, and surface runoff is medium. The available water capacity is moderate. Natural fertility and the organic matter content are low. The surface layer is friable, but it tends to crust after heavy rains.

A few areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain if erosion is controlled. A system of conservation tillage that leaves a protective amount of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Proper management of crop residue and green manure crops help to control erosion, maintain or increase the organic matter content, improve tilth, and increase the rate of water infiltration.

Most areas are used for hay and pasture. This soil is well suited to alfalfa, red clover, lespedeza, orchardgrass, tall fescue, big bluestem, switchgrass, and other commonly grown legumes and warm- and cool-season grasses. No serious problems affect the use of this soil as pasture and hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good plant cover.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential, the moderate permeability, and the depth to bedrock are limitations. Constructing foundations, basement walls, and footings with adequately reinforced concrete helps to prevent the damage to buildings caused by shrinking and swelling. The design of dwellings with basements and of septic tank absorption fields should compensate for the limited depth to bedrock. Special design or some blasting may be necessary for basements. Enlarging the absorption fields helps to overcome the depth to bedrock and the moderate permeability. Sewage lagoons function properly if the site can be leveled and if enough soil material is available for the bottom and berms.

If this soil is used as a site for local roads and streets, low strength, the shrink-swell potential, and frost action are limitations. Low strength can be overcome by adding crushed rock or other suitable material to the road base. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

5D2—Bucklick silty clay loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, well drained soil is on narrow, convex ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 4 to 35 acres in size.

Typically, the surface layer is strong brown, friable silty clay loam about 7 inches thick. The subsoil is firm silty clay about 35 inches thick. It is yellowish red in the upper part and red in the lower part. Hard limestone bedrock is at a depth of about 42 inches. Some areas have a karst topography. In places the surface layer is silt loam or silty clay loam more than 10 inches thick.

Included with this soil in mapping are some areas of Gasconade soils and some outcrops of limestone bedrock on the lower slopes and in drainageways. Also included are some areas of the cherty Goss soils on the

upper side slopes. Included areas make up about 10 percent of the unit.

Permeability is moderate in the Bucklick soil, and surface runoff is rapid. The available water capacity is moderate. Natural fertility and the organic matter content are low. The surface layer is friable, but it tends to crust after heavy rains. Also, tillage can be hindered by the bedrock outcrops or by coarse fragments.

Most areas are used as pasture or woodland. Where the size and shape of the areas are favorable, this soil is suited to row crops grown on a limited basis in a rotation that includes pasture and hay. If cultivated crops are grown, erosion is a severe hazard. A system of conservation tillage that leaves a protective amount of crop residue on the surface, grassed waterways, and crop rotations that include grasses and legumes help to prevent excessive soil loss. Because the soil is highly susceptible to gullying, waterways should be carefully designed and maintained. Proper management of crop residue and green manure crops help to control erosion, improve fertility, and increase the rate of water infiltration.

This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Some areas support native hardwoods. This soil is suited to trees. Seedlings survive and grow well if competing vegetation is removed or controlled by proper site preparation or by spraying or selective cutting. No other hazards or limitations affect planting or harvesting.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential, the moderate permeability, and the slope are limitations. Constructing foundations, basement walls, and footings with adequately reinforced concrete helps to prevent the damage to buildings caused by shrinking and swelling. The design of dwellings and septic tank absorption fields should compensate for the natural slope of the land and the limited depth to bedrock. Land shaping may be necessary in some areas. Some blasting of bedrock may be necessary. Enlarging the absorption fields helps to overcome the moderate permeability. Sewage lagoons function properly if the site can be leveled and if enough soil material is available for the bottom and berms.

If this soil is used as a site for local roads and streets, low strength, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling. Cutting and filling are needed in some areas.

The land capability classification is IVe. The woodland ordination symbol is 3A.

5E2—Bucklick silty clay loam, 14 to 20 percent slopes, eroded. This deep, moderately steep, well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 6 inches thick. The subsoil is about 37 inches thick. It is yellowish red, firm silty clay loam in the upper part and red, firm silty clay in the lower part. The substratum is red, firm cherty silty clay about 7 inches thick. Hard limestone bedrock is at a depth of about 50 inches. Some areas have a karst topography.

Included with this soil in mapping are some outcrops of limestone bedrock. Also included are some areas of the cherty Goss soils on the upper side slopes and the shallow Gasconade soils on the lower side slopes. Included areas make up about 10 to 15 percent of the unit.

Permeability is moderate in the Bucklick soil, and surface runoff is rapid. The available water capacity is moderate. Natural fertility and the organic matter content are low. The surface layer is friable, but it tends to crust after heavy rains. Also, tillage can be hindered by coarse fragments or by the outcrops of bedrock.

Most areas are used as pasture or woodland. Because of the slope and a severe hazard of erosion, this soil is unsuited to cultivated crops. It is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Many areas support native hardwoods. This soil is suited to trees. The erosion hazard and the equipment limitation are management concerns. Constructing logging roads and skid trails on the contour and seeding disturbed areas after the trees are harvested help to control erosion. In the steeper area, the logs should be yarded uphill to logging roads or skid trails. Selective cutting and thinning are needed in existing timber stands. New stands should be protected from fire and overgrazing. Good woodland management improves the habitat for woodland wildlife, especially white-tailed deer and wild turkeys.

Because of the slope and the depth to bedrock, this soil generally is not used for building site development or

onsite waste disposal. The cost of overcoming these limitations can be prohibitive.

The land capability classification is VIe. The woodland ordination symbol is 3R.

6C2—Crider silt loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, well drained soil is on ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 5 to about 40 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil extends to a depth of about 60 inches. The upper part is dark brown, friable silt loam, and the lower part is dark brown and reddish brown, firm silty clay loam. Some areas have a karst topography. In severely eroded areas the depth to the reddish brown layer is less than 20 inches.

Included with this soil in mapping are a few areas of Bucklick soils and limestone rock outcrops on some of the lower side slopes and in drainageways. Bucklick soils have more clay in the subsoil than the Crider soil. Included areas make up about 5 percent of the unit.

Permeability is moderate in the Crider soil, and surface runoff is medium. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled.

Most areas are used for pasture or hay. This soil is suited to corn, soybeans, and small grain if erosion is controlled. Erosion has already removed most of the original darkened surface layer. A system of conservation tillage that leaves a protective amount of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. In some areas slopes are long and smooth enough for terracing and farming on the contour. Proper management of crop residue and green manure crops help to control erosion, maintain or increase the organic matter content, improve tilth, and increase the rate of water infiltration.

This soil is well suited to alfalfa, red clover, lespedeza, orchardgrass, tall fescue, big bluestem, switchgrass, and other commonly grown legumes and warm- and cool-season grasses. No serious problems affect the use of this soil for pasture and hay. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good plant cover.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential is a limitation on sites for dwellings with basements. Constructing footings and basement walls with adequately reinforced concrete helps to prevent structural damage caused by shrinking and swelling. Septic tank absorption fields can function well if they are properly installed. Sewage lagoons can function properly if the site is leveled. Sealing the berms and bottom of the lagoons with slowly permeable material helps to prevent seepage.

If this soil is used as a site for local roads and streets, low strength and frost action are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

6D2—Crider silt loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, well drained soil is on narrow, convex ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil to a depth of about 60 inches is firm silty clay loam. It is dark yellowish brown in the upper part, dark brown in the next part, and yellowish red in the lower part. In a few areas the subsoil is not so red and has gray mottles in the lower part. In severely eroded areas, the surface layer is silty clay loam and a subsoil layer of reddish clay loam is within a depth of 20 inches. Some areas have a karst topography.

Included with this soil in mapping are small areas of the moderately well drained Keswick soils around the head of small drainageways, small areas of the cherty Goss soils on short, steep side slopes, and areas of Bucklick soils on the lower slopes and in drainageways. Bucklick soils have more clay in the subsoil than the Crider soil. Also included are rock outcrops in and along the drainageways. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Crider soil, and surface runoff is rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. The surface layer is friable, but it tends to crust after hard rains because it is mixed with some subsoil material.

Most areas are used for pasture, hay, or woodland. Where the size and shape of the areas are favorable, this soil is suited to row crops grown on a limited basis in rotations that include pasture and hay. If cultivated crops are grown, erosion is a severe hazard. It has already removed most of the original darkened surface layer and in places part of the subsoil. A system of conservation tillage that leaves a protective amount of crop residue on the surface, terraces and grassed waterways, and crop rotations that include grasses and legumes help to prevent excessive soil loss. Because the soil is highly susceptible to gullying, waterways should be carefully designed and maintained. Proper management of crop residue and green manure crops help to control erosion,

maintain or increase the organic matter content, improve tilth, and increase the rate of water infiltration.

This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Some areas support native hardwoods. This soil is suited to trees. Seedlings survive and grow well if competing vegetation is removed or controlled by proper site preparation or by spraying or selective cutting. No other hazards or limitations affect planting or harvesting.

This soil is suited to building site development and septic tank absorption fields. The slope and the shrink-swell potential are limitations. Dwellings can be designed so that they conform to the natural slope of the land. Constructing footings and basement walls with adequately reinforced concrete helps to prevent the structural damage caused by shrinking and swelling. Septic tank absorption fields should be installed across the slope. Land shaping is necessary in some areas.

If this soil is used as a site for local roads and streets, low strength and frost action are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action. Cutting and filling are needed in the steeper areas.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

6E—Crider silt loam, 14 to 20 percent slopes. This deep, moderately steep, well drained soil is on convex side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is dark yellowish brown, firm silty clay loam, and the lower part is reddish brown, firm silty clay. In places the lower part of the subsoil is not so red and has gray mottles. In eroded areas, the surface layer is silty clay loam and a subsoil layer of reddish clay loam is within a depth of 20 inches. Some areas have a karst topography.

Included with this soil in mapping are a few areas of the cherty Goss soils on short, steep side slopes on the lower parts of the landscape and areas of Bucklick soils in drainageways and on the lower slopes. Bucklick soils have more clay in the subsoil than the Crider soil. Also included are rock outcrops in and along drainageways. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Crider soil, and surface runoff is rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled, but it tends to crust after heavy rains, especially where it has been mixed with subsoil material.

Most areas are used as pasture or woodland. This soil generally is suited to row crops grown on a limited basis in rotation with pasture and hay. The slope and a severe hazard of erosion are management concerns if the soil is used for row crops. A system of conservation tillage that leaves a protective amount of crop residue on the surface helps to prevent excessive soil loss. Proper management of crop residue and green manure crops help to control erosion, improve fertility, and increase the rate of water infiltration.

This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Some areas support native hardwoods. This soil is suited to trees. The erosion hazard and the equipment limitation are management concerns. Constructing logging roads and skid trails on the contour and seeding disturbed areas after the trees are harvested help to control erosion. In steeper areas, the logs should be yarded uphill to logging roads or skid trails. Selective cutting and thinning are needed in existing timber stands. New stands should be protected from fire and overgrazing. Good woodland management improves the habitat for woodland wildlife, especially white-tailed deer and wild turkeys.

Because of the slope, this soil generally is not used for building site development or onsite waste disposal. The cost of overcoming this limitation can be prohibitive.

The land capability classification is IVe. The woodland ordination symbol is 3R.

7B—Menfro silt loam, 2 to 5 percent slopes. This deep, gently sloping, well drained soil is on the tops of ridges in the uplands. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 8 inches thick. The subsoil is brown, firm silty clay loam about 40 inches thick. The substratum to a depth of 60 inches or more is brown and dark yellowish brown, friable silt loam. In some areas on the lower side slopes, gray mottles are in the lower part of the subsoil. In a few areas the slope is more than 5 percent. Some areas have a karst topography.

Included with this soil in mapping are a few areas of soils that have a subsoil of silty clay. These soils make up about 5 percent of the unit.

Permeability is moderate in the Menfro soil, and surface runoff is medium in cultivated areas. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain if erosion is controlled. A system of conservation tillage that leaves a protective amount of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. In some areas slopes are long enough and smooth enough for terracing and farming on the contour. Proper management of residue and green manure crops improve fertility and increase the organic matter content and the rate of water infiltration.

This soil is well suited to alfalfa, red clover, lespedeza, orchardgrass, tall fescue, big bluestem, switchgrass, and other commonly grown legumes and warm- and cool-season grasses. No serious problems affect the use of this soil as pasture and hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good plant cover.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential is a limitation on sites for dwellings. Constructing footings, basement walls, and foundations with adequately reinforced concrete helps to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness around foundations in areas where surface drainage is poor and gutters fail. Properly installed septic tank absorption fields function adequately. Excessive seepage from sewage lagoons can be prevented by sealing the bottom of the lagoon.

If this soil is used as a site for local roads and streets, low strength, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling.

The land capability classification is IIe. The woodland ordination symbol is 3A.

7C2—Menfro silt loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, well drained soil is on the convex tops of ridges in the uplands. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 6 inches thick. The subsoil is about 36 inches thick. It is dark yellowish brown and brown, friable and firm silty clay loam in the upper part and brown, friable silt loam in the lower part. The substratum to a depth of 60 inches or more is brown, friable silt loam. In places the lower part of the subsoil is redder. Some areas have a karst topography.

Included with this soil in mapping are a few areas of soils that have a subsoil of silty clay. These soils make up about 5 percent of the unit.

Permeability is moderate in the Menfro soil, and surface runoff is medium in cultivated areas. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain and to orchards, vineyards, and nursery crops (fig. 6). If cultivated crops are grown, erosion is a severe hazard. It has removed most of the original darkened surface layer. A system of conservation tillage that leaves a protective amount of crop residue on the surface, terraces and grassed waterways, winter cover crops, and a cropping sequence that includes grasses and legumes help to prevent excessive soil loss. Proper management of crop residue and green manure crops help to control erosion, improve fertility, minimize crusting, and increase the organic matter content and the rate of water infiltration.

This soil is well suited to alfalfa, red clover, lespedeza, orchardgrass, tall fescue, big bluestem, switchgrass, and other commonly grown legumes and warm- and cool-season grasses. No serious problems affect the use of this soil as pasture and hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure rapid growth of a good plant cover.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential is a limitation on sites for dwellings. Constructing footings, basement walls, and foundations with adequately reinforced concrete helps to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness around foundations in areas where surface drainage is poor and gutters fail. Properly installed septic tank absorption fields function adequately. Seepage from sewage lagoons can be prevented by sealing the bottom of the lagoon.

If this soil is used as a site for local roads and streets, low strength, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they

Figure 6.—Nursery seedlings in an area of Menfro silt loam, 5 to 9 percent slopes, eroded.

shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

7D2—Menfro silt loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, well drained soil is on narrow ridgetops and the upper side slopes in the uplands. Individual areas generally are long and narrow. They range from 10 to 100 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 6 inches thick. The subsoil to a depth of 60 inches or more is brown and dark yellowish brown, friable silty clay loam. In some areas on the lower side slopes, the lower part of the subsoil has gray mottles. In places it is redder. A few areas have a karst topography.

Included with this soil in mapping are some small areas of rock outcrops in drainageways and on the lower slopes. Included areas make up about 2 percent of the unit.

Permeability is moderate in the Menfro soil, and surface runoff is rapid in cultivated areas. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. The shrink-swell potential is moderate. The surface layer is friable, but it tends to crust after heavy rains.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a severe hazard. It has already removed most of the original darkened surface layer. A system of conservation tillage that leaves a protective amount of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. Many slopes are long enough and smooth enough for terracing and farming on the contour. Gullies should be shaped and seeded to grass. Proper management of crop residue and green manure crops help to control erosion, increase the organic matter content, improve tilth, and increase the rate of water infiltration.

This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Many areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential and the slope are limitations. Constructing basement walls, footings, and foundations with adequately reinforced concrete helps to prevent the damage to buildings caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent excessive wetness around foundations in areas where surface drainage is poor and gutters fail. Dwellings can be designed so that they conform to the natural slope of the land, but land shaping is needed in some areas. Properly installed septic tank absorption fields function adequately if the distribution lines are installed across the slope.

If this soil is used as a site for local roads and streets, low strength, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling. Cutting and filling are needed in the steeper areas.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

7E2—Menfro silt loam, 14 to 20 percent slopes, eroded. This deep, moderately steep, well drained soil is on dissected side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 4 inches thick. The subsoil is about 40 inches thick. It is brown, firm silty clay loam in the upper part and brown, friable silt loam in the lower part. The substratum to a depth of 60 inches or more is brown, friable silt loam. In some areas on the lower side slopes, the lower part of the subsoil has gray mottles. In places it is redder. Some areas have a karst topography.

Included with this soil in mapping are a few small areas of rock outcrops on the lower side slopes and in drainageways. Included areas make up about 2 percent of the unit.

Permeability is moderate in the Menfro soil, and surface runoff is rapid. The available water capacity is high. The shrink-swell potential is moderate. Natural fertility is medium, and the organic matter content is moderately low. The surface layer is friable, but it tends to crust after heavy rains because it is mixed with some subsoil material.

Most areas of this soil are used for pasture, hay, or woodland. Erosion has removed the original darkened surface layer. In areas where terraces adequately protect the soil against erosion, cultivated crops can be grown on a limited basis in rotation with pasture and hay. A system of conservation tillage that leaves a protective amount of crop residue on the surface and terraces that have steep, grassed back slopes are needed. The soil is highly susceptible to gullying. As a result, waterways should be carefully designed and maintained. Crop residue management and applications of barnyard manure improve fertility and increase the rate of water infiltration.

This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Many areas support native hardwoods, dominantly good-quality white oak. This soil is suited to trees. The erosion hazard and the equipment limitation are management concerns. Constructing logging roads and skid trails on the contour and seeding disturbed areas after the trees are harvested help to control erosion.

Because of the slope, logs should be yarded uphill to logging roads or skid trails.

Although the slope is a severe limitation, this soil is suited to building site development and septic tank absorption fields. It can be used for low-density urban development if the site is extensively prepared. The cost of such preparation, however, can be prohibitive. Dwellings can be designed so that they conform to the natural slope of the land, but land grading is necessary in some areas. Properly designing the buildings and constructing the footings and foundations with adequately reinforced concrete help to prevent the structural damage caused by shrinking and swelling. Measures that control the rapid runoff are needed on construction sites.

If this soil is used as a site for local roads and streets, low strength, frost action, the slope, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling. Cutting and filling are needed in the steeper areas.

The land capability classification is IVe. The woodland ordination symbol is 3R.

7F—Menfro silt loam, 20 to 30 percent slopes. This deep, steep, well drained soil is on dissected side slopes in the uplands. Individual areas are irregular in shape and range from 7 to 50 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The dark yellowish brown subsoil extends to a depth of 60 inches or more. It is friable silt loam in the upper part, firm silty clay loam in the middle part, and friable silt loam in the lower part. In some areas, the lower part of the subsoil is redder.

Included with this soil in mapping are small areas of the cherty Goss soils on the lower part of the side slopes and some rock outcrops in drainageways and on the lower slopes. Included areas make up about 5 percent of the unit.

Permeability is moderate in the Menfro soil, and surface runoff is very rapid. The available water capacity is high. Natural fertility is medium, and the organic matter is moderately low. The shrink-swell potential is moderate.

This soil is not suitable as cropland. It should be tilled only when pasture renovation is needed. The soil is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa, orchardgrass, indiangrass, and most other warm-season grasses. The steep, uneven slopes and erosion during seedbed preparation are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Most areas support native hardwoods. This soil is suited to trees. The erosion hazard and the equipment limitation are management concerns. Constructing logging roads and skid trails on the contour and seeding disturbed areas after the trees are harvested help to control erosion. Because of the slope, logs should be yarded uphill to logging roads or skid trails. In most existing stands, thinning and selective cutting are needed. New stands should be protected from fire and overgrazing. Good woodland management improves the habitat for woodland wildlife, especially white-tailed deer and wild turkeys.

Because of the slope, this soil generally is unsuited to building site development and onsite waste disposal. It can be used for low-density building site development, however, if the site is extensively prepared. The cost of such preparation can be prohibitive.

The land capability classification is VIe. The woodland ordination symbol is 3R.

10F—Gasconade-Rock outcrop complex, 9 to 70 percent slopes. This map unit occurs as areas of a shallow, strongly sloping to very steep, somewhat excessively drained Gasconade soil intermingled with areas of Rock outcrop. The unit is on highly dissected side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 100 acres in size. They are about 60 percent Gasconade soil and 30 percent Rock outcrop. The Gasconade soil and the Rock outcrop occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the surface layer of the Gasconade soil is very dark grayish brown, friable very flaggy silty clay loam about 5 inches thick. The subsoil is very dark grayish brown, firm very flaggy silty clay about 9 inches thick. Hard limestone bedrock is at a depth of about 14 inches.

The Rock outcrop consists of nearly vertical ledges and horizontal exposures of limestone bedrock. The exposures range from 1 square yard to several square yards in size.

Included with this unit in mapping are areas of soils that are more than 20 inches deep over bedrock. These soils make up about 10 percent of the unit.

Permeability is moderately slow in the Gasconade soil, and surface runoff is very rapid. The available water capacity is very low. Natural fertility is low, and the organic matter content is moderate. The shrink-swell potential also is moderate. The rooting depth is restricted by the bedrock within a depth of 20 inches.

This map unit is not suited to pasture or hay. Because of the slope and the Rock outcrop, tillage is nearly impossible. The Gasconade soil is shallow and droughty. It is poorly suited to alsike clover, big bluestem, little bluestem, and indiangrass.

Nearly all areas support eastern redcedar and post oak. The eastern redcedar is used for fenceposts and

furniture and the post oak is used for firewood. Most of the timber is harvested as posts or small logs. The erosion hazard, the equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Logging roads and skid trails should be constructed on the contour. Because of restricted productivity, extensive timber management is not warranted.

The Gasconade soil generally is unsuited to building site development and onsite waste disposal because of the slope and the shallow depth to bedrock.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Gasconade soil is 2R.

12—Kennebec silt loam. This deep, nearly level, moderately well drained soil is on flood plains along small streams and their tributaries. It is occasionally flooded for brief periods. Individual areas are irregular in shape and range from 3 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The subsurface layer is about 17 inches of very dark gray and very dark grayish brown, friable silty clay loam. The substratum extends to a depth of 60 inches or more. It is dark grayish brown, friable silty clay loam in the upper part and grayish brown, very friable silt loam in the lower part. In some areas the surface layer is brown overwash.

Included with this soil in mapping are some areas of the well drained Haymond soils in the higher landscape positions and a few areas of the poorly drained Moniteau soils on low terraces. Haymond soils are lighter colored than the Kennebec soil. Included soils make up about 5 percent of the unit.

Permeability is moderate in the Kennebec soil, and surface runoff is slow. The available water capacity is very high. The seasonal high water table is at a depth of 3 to 5 feet during the winter. The shrink-swell potential is moderate. Natural fertility and the organic matter content are high. The surface layer is friable and can be easily tilled.

Nearly all areas are used for cultivated crops. This highly productive soil is well suited to all of the crops commonly grown in the county. No major problems affect farming. Minor problems include the occasional flooding and streambank erosion.

This soil is well suited to alfalfa, red clover, orchardgrass, and switchgrass. It is moderately well suited to lespedeza and smooth bromegrass. It also is moderately well suited to indiangrass and most other warm-season grasses. The occasional flooding is the main problem. The haying and grazing system should accommodate the periods of flooding.

A few small areas support timber. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the occasional flooding, this soil generally is unsuitable for building site development and onsite waste disposal.

The land capability classification is IIw. The woodland ordination symbol is 9A.

16D2—Minnith silty clay loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer is brown, friable silty clay loam about 6 inches thick. The subsoil extends to a depth of about 60 inches or more. It is strong brown, firm silty clay loam in the upper part and yellowish brown, mottled, friable sandy clay loam in the lower part. In some small areas the subsoil is not mottled. In places the surface layer is silt loam.

Included with the soil in mapping are some areas of rock outcrops and the shallow Ramsey soils in drainageways and on the lower slopes. Included areas make up about 5 percent of the unit.

Permeability is moderately slow in the Minnith soil, and surface runoff is rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. The shrink-swell potential is moderate. The surface layer is friable, but it tends to crust after heavy rains.

Most areas are used for pasture, hay, or woodland. Where the size and shape of the areas are favorable, this soil is suited to row crops grown on a limited basis in rotations that include pasture and hay. If cultivated crops are grown, erosion is a severe hazard. It has removed most of the original darkened surface layer and part of the subsoil. A system of conservation tillage that leaves a protective cover of crop residue on the surface, terraces, grassed waterways, and a cropping sequence that includes grasses and legumes help to prevent excessive soil loss. Because the soil is highly susceptible to gullying, waterways should be carefully designed and maintained. Proper management of crop residue and green manure crops help to control erosion, improve fertility, and increase the organic matter content and the rate of water infiltration.

This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Some areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect

planting or harvesting. Thinning or selective cutting is needed in the existing timber stands.

This soil is suited to building site development and septic tank absorption fields. The shrink-swell potential, the slope, and the restricted permeability are limitations. Constructing footings, foundations, and basement walls with adequately reinforced concrete helps to prevent the damage to buildings caused by shrinking and swelling. Dwellings can be designed so that they conform to the natural slope of the land. Installing drainage tile around the footings helps to prevent excessive wetness around foundations in areas where surface drainage is poor and gutters fail. Septic tank absorption fields can function properly if the distribution lines are installed across the slope and if the absorption area is enlarged. Land shaping is necessary in some areas. Sewage lagoons generally are not constructed on this soil.

If this soil is used as a site for local roads and streets, low strength, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling. Cutting and filling are needed in the steeper areas.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

17F—Ramsey-Minnith-Rock outcrop complex, 9 to 65 percent slopes. This map unit consists of a shallow, somewhat excessively drained Ramsey soil, a deep, well drained Minnith soil, and areas of Rock outcrop. The soils in this unit range from strongly sloping to very steep. Slopes are long, and drainageways are deeply incised into the landscape. The Ramsey soil is on the lower parts of side slopes. The Minnith soil is on the upper parts of side slopes and foot slopes. The Rock outcrop is intermingled throughout areas of the Ramsey soil. Individual areas range from 100 to 700 acres in size. They are about 40 percent Ramsey soil, 40 percent Minnith soil, and 20 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the Ramsey soil has a surface layer of dark brown, very friable loam about 6 inches thick. The subsoil is dark yellowish brown, very friable loam about 6 inches thick. Hard sandstone bedrock is at a depth of about 12 inches. In a few places the depth to bedrock is more than 20 inches.

Typically, the Minnith soil has a surface layer of dark brown, friable silt loam about 3 inches thick. The upper part of the subsoil is dark yellowish brown, friable silt loam and firm silty clay loam. The lower part to a depth of about 60 inches is strong brown, friable loam and sandy clay loam. In some areas the depth to the lower part of the subsoil is less than 24 inches. In other areas the subsoil is brown silty clay loam throughout.

The Rock outcrop consists of vertical ledges and nearly horizontal exposures of bedrock. The horizontal exposures range from 1 square yard to several square yards in size. The vertical ledges are 1 to 10 feet high and several feet to several hundred feet long.

Permeability is rapid in the Ramsey soil and moderately slow in the Minnith soil. Surface runoff is rapid throughout the map unit. The available water capacity is very low in the Ramsey soil and high in the Minnith soil. Natural fertility and the organic matter content are low in the Ramsey soil. Natural fertility is medium and the organic matter content moderately low in the Minnith soil.

Nearly all areas are used as woodland. The Ramsey and Minnith soils are suited to trees. The hazard of erosion and the equipment limitation are management concerns on the Ramsey and Minnith soils. The seedling mortality rate and the hazard of windthrow are additional management concerns on the Ramsey soil. Logging roads and skid trails should be carefully designed and constructed. In the steeper areas logs can be yarded uphill to the roads and skid trails. Properly managing the ground cover and seeding disturbed areas help to control erosion. The rate of seedling survival can be increased by planting container-grown nursery stock in areas where reinforcement planting is needed. Stands that are too dense for maximum tree growth should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

The Ramsey and Minnith soils generally are unsuitable as sites for buildings and waste disposal, mainly because of the slope. The depth to bedrock in the Ramsey soil also is a limitation. The soils can be used for low-density development if site preparation is extensive. The cost of such preparation, however, can be prohibitive.

The land capability classification is VIIe. The woodland ordination symbol assigned to the Ramsey soil is 2R, and that assigned to the Minnith soil is 3R.

22F—Goss-Gasconade-Brussels complex, 9 to 70 percent slopes. These strongly sloping to very steep soils are in areas on uplands where slopes are long and drainageways are deeply incised into the landscape. The deep, well drained Goss soil is on the upper part of side slopes and at the head of drainageways. The shallow, somewhat excessively drained Gasconade soil is on short side slopes below the Goss soil. The deep, well drained Brussels soil is on the lowest part of the side slopes, at elevations below the Gasconade soil. Individual areas range from 10 to more than 500 acres in size. They are about 40 percent Goss soil, 25 percent Gasconade soil, and 25 percent Brussels soil. The three soils occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the Goss soil has a surface layer of dark brown cherty silt loam about 5 inches thick. The subsurface layer is brown very cherty silty clay loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more. It is red and firm. The upper part is very cherty silty clay loam, and the lower part is very cherty clay. In some areas the surface layer is silt loam.

Typically, the Gasconade soil has a surface layer of very dark grayish brown, friable very flaggy silty clay loam about 4 inches thick. The subsoil is very dark grayish brown, firm very flaggy silty clay about 9 inches thick. Hard, fractured limestone bedrock is at a depth of about 13 inches. In places the subsoil is dark reddish brown.

Typically, the Brussels soil has a surface layer of black, firm very flaggy silty clay loam about 5 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is very dark grayish brown and dark brown, firm very flaggy silty clay, and the lower part is brown, firm very flaggy silty clay loam. In some areas the surface layer is very channery silty clay loam.

Included with these soils in mapping are scattered small areas of the well drained Crider and Bucklick soils. Also included are soils that are 20 to 40 inches deep over bedrock. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Goss soil and moderately slow in the Gasconade and Brussels soils. Surface runoff is very rapid on all three soils. The available water capacity is low in the Goss soil and very low in the Gasconade and Brussels soils. Natural fertility is low in all three soils. The organic matter content is moderately low in the Goss soil and moderate in the Brussels and Gasconade soils.

These soils generally are unsuited to cultivated crops and hay because of the slope, the high content of chert, and droughtiness. In a few areas the Goss soil is cleared of trees and is used as pasture. It is moderately suited to crownvetch, lespedeza, and tall fescue. The Gasconade and Brussels soils are not suited to hay or pasture.

Most areas support native hardwoods. The Goss and Brussels soils are suited to trees, but the Gasconade soil is not suited. Intensive timber management should be confined to areas of the Goss and Brussels soils. The hazard of erosion, the equipment limitation, and the seedling mortality rate are management concerns. Logging roads and skid trails should be carefully designed and constructed. In the steeper areas, logs can be yarded uphill to the roads and skid trails. Properly managing the ground cover and seeding disturbed areas help to control erosion. The rate of seedling survival can be increased by planting container-grown nursery stock in areas where reinforcement planting is needed. Many areas of the Goss and Brussels soils can provide habitat for wildlife, especially deer, grouse, and wild turkeys.

These soils generally are unsuitable for building site development and onsite waste disposal because of the slope of all three soils and the shallow depth to bedrock in the Gasconade soil. The soils can be used for low-density building site development if the site is extensively prepared, but the cost of such preparation can be prohibitive.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Goss and Brussels soils is 3R, and that assigned to the Gasconade soil is 2R.

24C2—Keswick silt loam, 5 to 9 percent slopes, eroded. This deep, moderately sloping, moderately well drained soil is on narrow ridgetops and side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 7 inches thick. The subsoil is firm clay about 41 inches thick. The upper part is yellowish red, the next part is yellowish red and mottled, and the lower part is dark brown and strong brown and is mottled. The substratum to a depth of 60 inches or more is yellowish brown, mottled, firm clay loam. In severely eroded areas the surface layer is silty clay loam. Some areas have a karst topography. In some places the soil has a dark surface layer more than 6 inches thick. In other places the subsoil is browner and has a lower content of sand and glacial pebbles.

Included with this soil in mapping are some areas of the nearly level Kennebec soils in narrow drainageways. These soils make up 10 to 15 percent of the unit.

Permeability is slow in the Keswick soil, and surface runoff is medium in cultivated areas. The available water capacity is moderate. A perched water table is at a depth of 1 to 3 feet during most of the winter and spring. Natural fertility is low, and the organic matter content is moderately low. The shrink-swell potential is high.

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a severe hazard. It has already removed most of the original darkened surface layer and in places part of the subsoil. Terraces, grassed waterways, a system of conservation tillage that leaves a protective amount of crop residue on the surface, and crop rotations that include hay and pasture help to prevent excessive soil loss. Proper management of crop residue and green manure crops improve fertility and increase the rate of water infiltration.

This soil is well suited to ladino clover. It is moderately well suited to crownvetch, tall fescue, switchgrass, timothy, and most other warm- and cool-season grasses. It is moderately suited to alfalfa (fig. 7) and orchardgrass. The species that can withstand the wetness grow best. Timely tillage and a quickly established plant cover help to prevent excessive erosion.

This soil is suited to trees. Seedling mortality and windthrow are management concerns. Planting container-grown nursery stock increases the seedling

Figure 7.—Alfalfa in an area of Keswick silt loam, 5 to 9 percent slopes, eroded.

survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Because of the slow permeability, this soil is unsuited to septic tank absorption fields. It is suited to building site development and sewage lagoons. The high shrink-swell potential and the wetness are limitations on sites for dwellings. Constructing foundations and footings with adequately reinforced concrete helps to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent the damage caused by excessive wetness. Sewage lagoons can function adequately if the site is leveled.

If this soil is used as a site for local roads and streets, low strength, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

24D2—Keswick silt loam, 9 to 14 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from 20 to 100 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 9 inches thick. The subsoil to a depth of 60 inches or more is strong brown, firm clay. It is mottled in the lower part. In severely eroded areas the surface layer is silty clay loam. Some areas have a karst topography, and other areas are moderately sloping.

Included with this soil in mapping are some small areas of the well drained Bucklick, Brevator, and Goss soils on the lower side slopes. Goss soils are cherty. Included soils make up about 5 percent of the unit.

Permeability is slow in the Keswick soil, and surface runoff is rapid in cultivated areas. The available water capacity is moderate. Natural fertility is low, and the organic matter content is moderately low. A perched

water table is at a depth of 1 to 3 feet during most winter and spring months. The shrink-swell potential is high. Root development is somewhat restricted by the clayey glacial till below a depth of about 25 inches.

Most areas are used as pasture, hayland, or woodland. This soil is suited to cultivated crops grown on a limited basis in rotations that include pasture and hay. If cultivated crops are grown, erosion is a severe hazard. It has already removed most of the original darkened surface layer and in places part of the subsoil. A system of conservation tillage that leaves a protective amount of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. Areas that are long enough and smooth enough can be terraced and farmed on the contour. Proper management of crop residue and green manure crops help to control erosion, maintain tilth, and increase the organic matter content and the rate of water infiltration.

This soil is well suited to ladino clover. It is moderately suited to crownvetch, lespedeza, tall fescue, big bluestem, and switchgrass. Erosion is the main problem. A good ground cover is necessary at all times if forage production is to be maintained. Overgrazing should be avoided. Nurse crops help to control erosion in newly seeded areas.

Many areas support native hardwoods. This soil is suited to trees. Seedling mortality and windthrow are management concerns. Planting container-grown nursery stock increases the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Because of the slow permeability, this soil is unsuited to septic tank absorption fields. It is suited to building site development and sewage lagoons. The wetness, the high shrink-swell potential, and the slope are limitations. Constructing basement walls, foundations, and footings with adequately reinforced concrete help to prevent the damage to buildings caused by shrinking and swelling. Installing drainage tile around the footings helps to prevent the damage caused by excessive wetness. Dwellings can be designed so that they conform to the natural slope of the land, but land shaping is needed in some areas. Sewage lagoons can function adequately if the site is leveled.

If this soil is used as a site for local roads and streets, low strength, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling. Cutting and filling are needed in the steeper areas.

The land capability classification is IVe. The woodland ordination symbol is 3C.

31B—Hatton silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on the narrow tops of ridges in the uplands. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is dark yellowish brown, firm silty clay. The lower part is yellowish brown, mottled, firm silty clay loam. In some areas the soil has a dark surface layer more than 6 inches thick. In other areas it is moderately sloping. A few areas have a karst topography.

Included with this soil in mapping are small areas of the somewhat poorly drained, nearly level Mexico soils on the ridgetops. These soils make up about 5 percent of the unit.

Permeability is very slow in the Hatton soil. Surface runoff is medium in cultivated areas. The available water capacity is moderate. Natural fertility is medium, and the organic matter content is moderately low. A perched water table is at a depth of 2 to 3 feet during most winter and spring months. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. Root development is somewhat restricted by the compactness of the lower part of the subsoil.

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. It can be controlled by terraces, grassed waterways, a system of conservation tillage that leaves a protective amount of crop residue on the surface, winter cover crops, and crop rotations that include hay and pasture. Insufficient soil moisture commonly affects row crops during the hot summer months. As a result, a high plant population of corn and grain sorghum should be avoided. In its natural state, the soil is quite acid and has a limited level of fertility. Returning crop residue to the soil and regularly adding barnyard manure improve fertility and increase the rate of water infiltration.

This soil is well suited to ladino clover. It is moderately well suited to crownvetch, tall fescue (fig. 8), switchgrass, timothy, and most other warm- and cool-season grasses. It is moderately suited to alfalfa and orchardgrass. The species that can withstand the moderate wetness grow best. Timely tillage and a quickly established plant cover help to prevent excessive erosion.

Some areas support native hardwoods. This soil is suited to trees. Seedling mortality and windthrow are management concerns. Planting container-grown nursery stock increases the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Because of the very slow permeability, this soil is not suitable as a site for septic tank absorption fields. It is

Figure 8.—Tall fescue on Hatton silt loam, 2 to 5 percent slopes. Brevator loam, 14 to 30 percent slopes, is on the wooded slopes in the background.

suitable as a site for dwellings and sewage lagoons. The wetness and the moderate shrink-swell potential are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in footings, foundations, and basement walls. Installing drainage tile around the footings helps to prevent the damage caused by excessive wetness. If the site is leveled, waste disposal can be handled by sewage lagoons.

Low strength, frost action, and the shrink-swell potential are limitations if this soil is used as a site for local roads and streets. Low strength can be overcome by strengthening the base with crushed rock or other suitable material. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling.

The land capability classification is IIe. The woodland ordination symbol is 3C.

31C—Hatton silt loam, 5 to 9 percent slopes. This deep, moderately sloping, moderately well drained soil is on the narrow, rounded tops of ridges in the uplands.

Individual areas are long and narrow and range from 10 to several hundred acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 4 inches thick. The subsurface layer is yellowish brown, very friable silt loam about 10 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish brown, firm silty clay; the next part is yellowish brown and dark yellowish brown, mottled, firm silty clay; and the lower part is yellowish brown, mottled, firm silty clay loam. Some areas have a karst topography, and other areas are gently sloping. In a few areas the soil has a dark surface layer more than 6 inches thick.

Included with this soil in mapping are small areas of the well drained, nearly level Menfro soils and some areas of the strongly sloping Keswick soils. Both of the included soils are on ridgetops. They make up about 5 percent of the unit.

Permeability is very slow in the Hatton soil, and surface runoff is medium. The available water capacity is moderate. A perched water table is at a depth of 2 to 3 feet during most winter and spring months. Natural fertility is medium, and the organic matter content is moderately low. The shrink-swell potential is moderate.

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a severe hazard. It can be controlled by a system of conservation tillage that leaves a protective amount of crop residue on the surface, winter cover crops, and a cropping sequence that includes hay and pasture. Terracing is difficult in many areas because of short, complex slopes. Insufficient soil moisture commonly affects row crops during the hot summer months. As a result, high plant populations of corn and grain sorghum should be avoided. In its natural state, the soil is quite acid and has a limited level of fertility. Proper management of crop residue and green manure crops improve fertility and increase the rate of water infiltration.

This soil is well suited to ladino clover. It is moderately well suited to crownvetch, tall fescue, switchgrass, timothy, and most other warm- and cool-season grasses. It is moderately suited to alfalfa and orchardgrass. The species that can withstand the wetness grow best. Timely tillage and a quickly established plant cover help to prevent excessive erosion.

Many areas support native hardwoods. This soil is suited to trees. Seedling mortality and windthrow are management concerns. Planting container-grown nursery stock increases the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Because of the very slow permeability, this soil is not suitable as a site for septic tank absorption fields. It is suitable as a site for dwellings and sewage lagoons. The wetness and the shrink-swell potential are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in footings, foundations, and basement walls. Installing drainage tile around the footings helps to prevent the damage caused by excessive wetness. If the site is leveled, waste disposal can be handled by sewage lagoons.

If this soil is used as a site for local roads and streets, low strength, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling. Cutting and filling are needed in the steeper areas.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

33—Haymond silt loam. This deep, nearly level, well drained soil is on flood plains along rivers and the smaller tributaries. It is occasionally flooded for brief periods. Individual areas generally are long and vary in width. They range from 10 to 100 acres in size.

Typically, the surface layer is brown, very friable silt loam about 11 inches thick. The substratum to a depth of 60 inches or more is brown and yellowish brown, very friable and friable silt loam. In places the surface layer is very dark grayish brown silt loam more than 6 inches thick.

Included with this soil in mapping are a few areas of Cedargap and Dameron soils. These soils contain more sand or coarse fragments than the Haymond soil. They generally occur as narrow bands along stream channels or in the upper reaches of narrow drainageways. Also included are areas of Kennebec soils, which have a thick, dark surface layer, and some areas along the main stream channels where the soil is somewhat poorly drained and is frequently flooded. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Haymond soil, and surface runoff is very slow. The available water capacity is moderate. Natural fertility is high, and the organic matter content is moderately low. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Nearly all areas are used for row crops. This soil is suited to corn, soybeans, and small grain. The occasional flooding and streambank erosion are minor problems. In some years planting is delayed because of the flooding.

This soil is well suited to alfalfa, red clover, orchardgrass, and switchgrass. It is moderately well suited to lespedeza and smooth bromegrass. It also is moderately well suited to indiangrass and most other warm-season grasses. The occasional flooding is the main problem. The haying or grazing system should accommodate the periods of flooding.

A few small areas support timber. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil generally is unsuitable for building site development and onsite waste disposal because of the occasional flooding.

The land capability classification is IIw. The woodland ordination symbol is 9A.

34F—Brevator loam, 14 to 30 percent slopes. This deep, moderately steep and steep, well drained soil is on dissected, uneven side slopes in the uplands. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is brown, very friable loam about 5 inches thick. The subsurface layer is brown, very friable cherty loam about 8 inches thick. The subsoil is about 32 inches thick. The upper part is red and strong brown, firm clay, and the lower part is yellowish brown, firm silty clay. The substratum to a depth of 60 inches or more also is yellowish brown, firm silty clay. Some areas have a karst topography. In eroded areas the surface layer is cherty.

Included with this soil in mapping are a few areas of the cherty Goss soils along deep drainageways. Also included are a few outcrops of limestone bedrock on some of the lower slopes. Included areas make up about 10 percent of the unit.

Permeability is moderately slow in the Brevator soil, and the surface runoff is rapid. The available water capacity is moderate. Natural fertility is low, and the organic matter content is moderately low. The shrink-swell potential is high.

A few areas are used for pasture and hay. Because of the erosion hazard, this soil is unsuited to cultivated crops. It is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Most areas support native hardwoods. This soil is suited to trees. The hazard of erosion and the equipment limitation are moderate. Logging roads and skid trails should be carefully designed and constructed. In the steeper areas, logs can be yarded uphill to the roads and skid trails. Properly managing the ground cover and seeding disturbed areas help to control erosion. In most of the existing stands, thinning and selective cutting are needed. New timber stands should be protected from fire and overgrazing. Good woodland management improves the habitat for woodland wildlife, especially white-tailed deer and wild turkeys.

This soil generally is unsuited to building site development and onsite waste disposal because of the slope. The cost of overcoming this limitation can be prohibitive.

The land capability classification is VIe. The woodland ordination symbol is 3R.

35B—Mexico silt loam, 1 to 5 percent slopes. This deep, gently sloping, somewhat poorly drained soil is on broad upland divides. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 9 inches thick. The subsoil is mottled, firm silty clay about 34 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is grayish brown, mottled, firm silty clay. In eroded areas the surface layer is silty clay loam. Some areas have a karst topography.

Included with this soil in mapping are some areas of the moderately well drained Hatton soils on narrow ridgetops and the moderately well drained Keswick soils on side slopes. Included soils make up 1 to 5 percent of the unit.

Permeability is very slow in the Mexico soil, and surface runoff is medium in cultivated areas. The available water capacity is high. A perched water table is at a depth of 1.0 to 2.5 feet during most winter and spring months. Natural fertility is medium, and the organic matter content is moderate. The shrink-swell potential is high. The surface layer is friable and can be easily tilled throughout a wide range in moisture content. It tends to crust or puddle, however, after heavy rains. Root development is somewhat restricted by the silty clay subsoil.

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves protective amounts of crop residue on the surface (fig. 9), winter cover crops, and grassed waterways help to prevent excessive soil loss. Most areas have slopes that are long enough and smooth enough to be terraced and farmed on the contour. Proper management of crop residue and green manure crops improve fertility, minimize crusting, and increase the rate of water infiltration.

This soil is well suited to ladino clover. It is moderately well suited to crownvetch, tall fescue, switchgrass, timothy, and most other warm- and cool-season grasses. It is moderately suited to alfalfa and orchardgrass. The species that can withstand the wetness grow best. Timely tillage and a quickly established plant cover help to prevent excessive erosion.

Because of the very slow permeability, this soil is not suitable as a site for septic tank absorption fields. It is suitable as a site for dwellings and sewage lagoons. The

Figure 9.—A protective cover of corn stubble on Mexico silt loam, 1 to 5 percent slopes.

wetness and the moderate shrink-swell potential are limitations. The structural damage caused by shrinking and swelling can be minimized by using adequately reinforced concrete in footings, foundations, and basement walls. Installing drainage tile around the footings helps to prevent the damage caused by excessive wetness. If the site is leveled, waste disposal can be handled by sewage lagoons.

If this soil is used as a site for local roads and streets, low strength, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by frost action and by shrinking and swelling.

The land capability classification is IIe. No woodland ordination symbol is assigned.

36—Putnam silt loam. This deep, nearly level, poorly drained soil is on broad upland divides. Individual areas are irregular in shape and range from 10 to about 100 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The subsurface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 36 inches thick. The upper part is dark grayish brown, mottled, very firm silty clay, and the lower part is grayish brown, mottled, firm silty clay loam. The substratum to a depth of 60 inches or more is gray, mottled, firm silty clay loam. In some areas the surface layer is lighter colored. In a few small areas, the upper part of the subsoil is not so gray and the slope is more than 1 percent.

Permeability is very slow in the Putnam soil, and surface runoff is slow. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderate. The available water capacity is

high. The shrink-swell potential also is high. A perched water table is at a depth of 0.5 foot to 1.5 feet during most winter and spring months. The surface layer is friable and can be easily tilled. Root development is somewhat restricted by the clayey subsoil.

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain. The slow runoff and the wetness may be problems after heavy rains. In some areas a surface drainage system is needed. The wetness sometimes delays fieldwork in the spring. Fertility can be improved or maintained by applications of lime and fertilizer, which should be added according to the results of soil tests. Proper management of crop residue and green manure crops help to maintain the organic matter content and tilth.

This soil is moderately well suited to birdsfoot trefoil, reed canarygrass, and switchgrass. It is moderately suited to alsike clover, ladino clover, and tall fescue. It also is moderately suited to bermudagrass and most other warm-season grasses. The wetness is the main problem. A surface drainage system is beneficial, especially if deep-rooted species are grown. A good seedbed can be easily prepared.

Because of the very slow permeability, this soil is not suitable as a site for septic tank absorption fields. It is suited to building site development and sewage lagoons. The wetness and the shrink-swell potential are severe limitations on sites for dwellings. Constructing foundations and footings with adequately reinforced concrete helps to prevent the structural damage caused by shrinking and swelling. Grading and filling, establishing shallow surface ditches, and installing drainage tile around footings help to prevent damage caused by wetness. If dwellings are constructed with basements, a suitable outlet for the drainage tile or a sump pump is needed. Sewage lagoons function adequately.

If this soil is used as a site for local roads and streets, low strength, wetness, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water, building on raised, well compacted fill material, and providing adequate side ditches and culverts help to prevent the damage caused by shrinking and swelling, wetness, and frost action.

The land capability classification is IIw. No woodland ordination symbol is assigned.

40—Moniteau silt loam. This deep, nearly level, poorly drained soil is on low stream terraces. It is subject to rare flooding, which lasts for very brief periods. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 9 inches thick. The subsurface layer also is dark grayish brown, very friable silt loam. It is about 6 inches thick. The subsoil to a depth of 60 inches or more is dark grayish brown and grayish brown, mottled, firm silty clay loam. In some areas the surface layer is darker.

Included with this soil in mapping are some areas of Twomile soils on the higher parts of the landscape and the well drained Haymond soils along the main stream channels. Twomile soils are more clayey than the Moniteau soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Moniteau soil, and surface runoff is slow. The available water capacity is high. Natural fertility is low, and the organic matter content is moderately low. A perched water table is within a depth of 1 foot during most of the winter and spring. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. The wetness is a problem. It can be reduced by a surface drainage system and by diversions, which keep water from the higher adjacent soils from running onto this soil. Returning crop residue to the soil helps to maintain fertility and tilth.

This soil is well suited to reed canarygrass. It is moderately well suited to lespedeza, red clover, and tall fescue. It is moderately well suited to switchgrass and is moderately suited to other warm-season grasses. The wetness is the main problem. A surface drainage system is beneficial, especially if deep-rooted species are grown. A good seedbed can be easily prepared.

This soil is suited to trees. The equipment limitation, seedling mortality, and windthrow are management concerns. Harvesting and planting should be restricted to periods when the soil is dry or frozen. Planting container-grown nursery stock increases the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Because of the rare flooding, this soil generally is unsuited to building site development and onsite waste disposal. Onsite investigation and knowledge of the previous flooding history are needed in any area that is considered for building site development.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

43—Cedargap silt loam. This deep, nearly level, well drained soil is on narrow flood plains along small streams. It is frequently flooded. Individual areas are long and narrow and range from 3 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 8 inches thick. The subsurface layer is very dark grayish brown, very friable very cherty silt loam about 24 inches thick. The substratum to a depth of 60 inches or more is very dark

grayish brown, very friable extremely cherty loam. In some places the surface layer is more than 10 inches thick. In other places it is cherty silt loam.

Permeability is moderately rapid, and surface runoff is slow. The available water capacity is low. Natural fertility also is low, and the organic matter content is moderate. The surface layer is very friable and can be easily tilled in all areas, except for the included cherty areas.

Some areas have been cleared of trees and are used for cultivated crops, hay, or pasture. In areas that are large enough for the use of equipment, this soil is suited to corn, soybeans, and small grain. Because of the low available water capacity, it is less well suited to corn and soybeans than to small grain. Insufficient soil moisture often affects row crops during hot summer months. The flooding is a hazard. It can delay planting.

This soil is well suited to ladino clover, bluegrass, tall fescue (fig. 10), and switchgrass. It is moderately well suited to lespedeza and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. The flooding is a problem in some years. The haying and grazing system should accommodate the periods of flooding.

Most areas support native hardwoods. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the occasional flooding, this soil generally is unsuitable for building site development and onsite waste disposal.

The land capability classification is IIIw. The woodland ordination symbol is 3A.

44—Dameron silt loam. This deep, nearly level, well drained soil is on flood plains along small streams and tributaries. It is occasionally flooded for very brief periods. Individual areas generally are long and narrow and range from 5 to 50 acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 8 inches thick. The subsurface layer also is dark brown, very friable silt loam. It is about 20 inches thick. The substratum to a depth of 60 inches or more is dark brown, friable very cherty silty clay loam.

Included with this soil in mapping are small areas of Cedargap and Haymond soils. Cedargap soils generally are at the head of drainageways. They have more chert in the upper part than the Dameron soil. Haymond soils are at the end of drainageways. They have no chert. Included soils make up about 5 percent of the unit.

Permeability is moderate in the upper part of the Dameron soil and moderately rapid in the lower part. Surface runoff is slow. The available water capacity is moderate. Natural fertility is medium, and the organic matter content is moderate. The surface layer is friable and can be easily tilled throughout a wide range in moisture content.

Many areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, and small grain. The flooding generally is not a problem during the growing season. Insufficient soil moisture often affects row crops during hot summer months. Irrigation is needed in most years. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

This soil is well suited to ladino clover, bluegrass, tall fescue, and switchgrass. It is moderately well suited to lespedeza and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. The droughtiness and the flooding are the main problems. Flood-tolerant species should be selected for planting.

Many areas support native hardwoods (fig. 11). This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the occasional flooding, this soil generally is unsuitable for building site development and onsite waste disposal.

The land capability classification is IIw. The woodland ordination symbol is 5A.

48C—Weller silt loam, 2 to 7 percent slopes. This deep, gently sloping and moderately sloping, moderately well drained soil is on ridgetops, side slopes, and loess-covered terraces. Individual areas are irregular in shape and range from 15 to 80 acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 9 inches thick. The subsurface layer is brown, friable silt loam about 3 inches thick. The subsoil extends to a depth of 60 inches or more. It is yellowish brown and mottled. It is firm and very firm silty clay in the upper part and firm silty clay loam in the lower part. In eroded areas the surface layer is silty clay loam.

Included with this soil in mapping are some short, steep slopes along the edge of most terraces. Also included are some scattered areas of the well drained Menfro soils and some areas where the slope is less than 2 percent. Included areas make up about 5 to 10 percent of the unit.

Permeability is slow in the Weller soil, and surface runoff is medium. The available water capacity is high. Natural fertility is medium, and the organic matter is moderately low. A perched water table is at a depth of 2 to 4 feet during most winter and spring months. The shrink-swell potential is high. The surface layer is very friable and can be easily tilled.

Most areas are used for cultivated crops, pasture, or hay. This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, erosion is a hazard. A system of conservation tillage that leaves a protective amount of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. Returning crop residue to the soil or regularly adding other organic material improve fertility, minimize crusting, and increase the rate of water infiltration.

Figure 10.—Tall fescue on Cedargap silt loam. Goss cherty silt loam, 14 to 50 percent slopes, is in the background.

This soil is well suited to ladino clover. It is moderately well suited to crownvetch, tall fescue, switchgrass, timothy, and most other warm- and cool-season grasses. It is moderately suited to alfalfa. The species that can withstand the wetness grow best. Timely tillage and a quickly established plant cover help to prevent excessive erosion.

A few small areas support native hardwoods. This soil is suited to trees. Seedling mortality and windthrow are management concerns. Planting container-grown nursery stock increases the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Because of the slow permeability, this soil is unsuitable as a site for septic tank absorption fields. It is suited to dwellings and sewage lagoons. The wetness and the shrink-swell potential are limitations on sites for dwellings. The structural damage caused by shrinking

Figure 11.—Black walnut trees and tall fescue on Dameron silt loam. Crider silt loam, 5 to 9 percent slopes, eroded, is in the background.

and swelling can be minimized by using adequately reinforced concrete in footings, foundations, and basement walls. Installing drainage tile around the footings helps prevent the damage caused by excessive wetness. If the site is leveled, sewage lagoons can function properly.

If this soil is used as a site for local roads and streets, low strength, wetness, frost action, and the shrink-swell potential are limitations. Strengthening the base with crushed rock or other suitable material helps to prevent the damage caused by low strength. Designing the roads so that they shed water and providing adequate side ditches and culverts help to prevent the damage caused by wetness, frost action, and shrinking and swelling.

The land capability classification is IIIe. The woodland ordination symbol is 3C.

61E—Crider silt loam, karst, 9 to 20 percent slopes. This deep, strongly sloping to moderately steep, well drained soil is in upland areas that have numerous sinkholes. The sinkholes commonly are a few feet to more than 100 feet deep and average 10 to 20 feet deep. They range from a few square yards to more than an acre in size. They commonly are funnel-shaped depressions, but the shape varies. Individual areas of this soil are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsoil to a depth of 60 inches or more is firm silty clay loam. The upper part is dark yellowish brown, and the lower part is reddish brown. In some areas the lower part of the subsoil is not so red.

Included with this soil in mapping are a few areas of Bucklick soils on the lower slopes. These soils are more clayey than the Crider soil. Also included are some areas of rock outcrops on the sides and bottom of some sinkholes. Included areas make up about 5 to 10 percent of the unit.

Permeability is moderate in the Crider soil, and surface runoff is rapid. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low.

Most areas are used as pasture. Because slopes are too steep and uneven, this soil generally cannot be used as cropland. It should be tilled only when pasture or hayland is reseeded. The soil is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Some areas support native hardwoods. This soil is suited to trees. The areas where the number and size of the sinkholes prohibit the use of farm equipment are probably best suited to woodland. In the small moderately steep areas around the edge of the sinkholes, the equipment limitation and erosion are management concerns, but they generally are not serious problems. Selective cutting and thinning and protection from fire and grazing are needed in existing stands. Good woodland management improves the habitat for woodland wildlife, especially white-tailed deer and wild turkeys.

This soil is suitable for building site development, particularly in the less steep areas between the sinkholes. Detailed onsite investigation is needed. Some areas are suitable as sites for septic tank absorption fields. The effluent can pollute the ground water, however, if it seeps into the sinkholes. As a result, detailed geologic investigation is needed.

The land capability classification is IVe. The woodland ordination symbol is 3R.

71D—Menfro silt loam, karst, 5 to 14 percent slopes. This deep, moderately sloping and strongly sloping, well drained soil is in upland areas that have numerous sinkholes. The sinkholes generally are 10 to 30 feet deep. They range from a few square yards to more than an acre in size. They commonly are funnel-shaped depressions, but the shape varies. Individual areas of this soil are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is dark yellowish brown, friable silt loam about 6 inches thick. The subsoil to a depth of 60 inches or more is brown, firm silty clay loam. In some areas bedrock crops out on the bottom of the sinkholes. In other areas the lower part of the subsoil is much redder.

Permeability is moderate, and surface runoff is medium. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low.

Most areas are used as pasture. This soil is suitable for corn, soybeans, and small grain in areas where the sinkholes are not so deep and numerous that they hinder the use of farm equipment. If cultivated crops are grown, erosion is a severe hazard. A system of conservation tillage that leaves a protective amount of crop residue on the surface and a cropping sequence that includes grasses and legumes help to prevent excessive soil loss. Wet spots at the bottom of some sinkholes are a problem.

This soil is well suited to crownvetch, red clover, tall fescue, and switchgrass. It is moderately well suited to alfalfa and orchardgrass. It also is moderately well suited to indiangrass and most other warm-season grasses. Erosion during seedbed preparation and overgrazing are the main management problems. Preparing the seedbed on the contour and in a timely manner helps to ensure rapid growth of a good plant cover. Overgrazing should be avoided. Measures that maintain fertility and control brush are necessary.

Some areas support native hardwoods. This soil is well suited to trees. The areas where the number and size of the sinkholes prohibit the use of farm equipment are probably best suited to woodland. Selective cutting is needed in existing stands. New stands should be protected from fire and grazing. Good woodland management improves the habitat for woodland wildlife, especially white-tailed deer and wild turkeys.

This soil is suitable for building site development, particularly in the moderately sloping areas between the sinkholes. Detailed onsite investigation is needed, especially if the soil is to be used for high-density urban development or is to be subject to heavy vehicular

traffic. The less sloping areas between the sinkholes are suitable for onsite waste disposal. The effluent can pollute the ground water, however, if it seeps into the sinkholes. As a result, detailed geologic investigation is needed.

The land capability classification is IIIe. The woodland ordination symbol is 3A.

79—Dupo silt loam. This deep, nearly level, somewhat poorly drained soil is on alluvial fans and in outwash areas on flood plains along rivers. It is protected by levees, but it is still subject to rare flooding because the levees can break. Individual areas are irregular in shape and range from 5 to more than 100 acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 8 inches thick. The substratum is 18 inches of mottled, dark brown, very friable silt loam. The next 13 inches is a buried surface layer of very dark gray, firm clay. Below this to a depth of about 60 inches is dark gray, mottled, firm clay. In places the depth to the buried surface layer is less than 20 inches.

Included with this soil in mapping are small areas of the well drained Haymond soils on the higher parts of the landscape. These soils make up about 5 percent of the unit.

Permeability is slow in the Dupo soil, and surface runoff is slow. The available water capacity is high. Natural fertility also is high, and the organic matter content is moderately low. A seasonal high water table is at a depth of 1.5 to 3.5 feet during most winter and spring months. The shrink-swell potential is high. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content.

Nearly all areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. Land grading helps to eliminate wet spots in the field. Returning crop residue to the soil helps to maintain fertility and tilth.

This soil is well suited to reed canarygrass. It is moderately well suited to lespedeza, red clover, and tall fescue. It is moderately well suited to switchgrass and is moderately suited to other warm-season grasses. The wetness is the main problem. A surface drainage system is beneficial especially if deep-rooted species are grown. A good seedbed can be easily prepared.

Because of the rare flooding, this soil generally is unsuitable for building site development and onsite waste disposal.

The land capability classification is IIw. No woodland ordination symbol is assigned.

80—Portage clay. This deep, nearly level, very poorly drained soil is in low drainageways and broad depressional areas on the flood plains along the Mississippi River. It is protected by levees, but it is still subject to rare flooding because the levees can break and the soil can receive runoff from the adjacent areas. Ponding is common after heavy rains. Individual areas generally are long and broad and range from 10 to more than 900 acres in size.

Typically, the surface layer is very dark gray, firm clay about 4 inches thick. The subsurface layer also is very dark gray, firm clay. It is about 16 inches thick. The subsoil to a depth of 60 inches or more is dark gray, mottled, firm clay. In some areas the dark surface soil is more than 24 inches thick.

Included with this soil in mapping are a few areas of Carlow soils at the slightly higher elevations. These soils are less clayey than the Portage soil. Also included are a few areas where the surface layer is overwash of dark grayish brown silty clay loam. Included soils make up about 10 percent of the unit.

Permeability is very slow in the Portage soil. Surface runoff also is very slow. The available water capacity is moderate. Natural fertility is medium, and the organic matter content is moderate. A seasonal high water table is near or above the surface during most winter and spring months. The shrink-swell potential is very high (fig. 12). The surface layer is firm and cannot be easily tilled. It tends to crust or puddle after heavy rains. Root development is restricted by poor aeration.

Nearly all areas are used for soybeans or winter wheat. Because of the wetness in spring and fall, the best suited crops on this soil are those that require a short growing season. The main management problems are the ponding and the clayey surface layer. Seedbeds should be prepared when the moisture content is optimal. Surface ditches or land grading and timely tillage are needed.

This soil is moderately well suited to reed canarygrass. It is moderately suited to alsike clover, bluegrass, and redtop. It is poorly suited to hay. The wetness and the flooding are the main management problems. The grazing system should accommodate the periods of flooding. Because of the wetness, maintaining stands of desirable species is difficult in the depressional areas. A surface drainage system is beneficial, especially if the deeper rooted species are grown.

A few areas support native timber. This soil is suited to water-tolerant trees. The equipment limitation, seedling mortality, and the windthrow hazard are the major management concerns. Equipment should be used only when the soil is dry or frozen. The seedling survival rate can be increased by ridging the soil and then planting container-grown nursery stock on the ridges. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely.

Because of the rare flooding, this soil generally is unsuitable for building site development and onsite waste disposal.

The land capability classification is IIIw. The woodland ordination symbol is 6W.

Figure 12.—A crack in an area of Portage clay, which has a very high shrink-swell potential.

82—Dockery silty clay loam. This deep, nearly level, somewhat poorly drained soil is on low natural levees and on islands. It is subject to frequent flooding. Individual areas are long and narrow and range from 10 to several hundred acres in size.

Typically, the surface layer is very dark gray, firm silty clay loam about 10 inches thick. The upper part of the substratum is very dark grayish brown, firm silty clay loam that has thin lenses of dark brown silt loam. The lower part to a depth of 60 inches or more is dark grayish brown, mottled, friable silt loam.

Included with this soil in mapping are some areas of sandy soils near the main river channels. Also included are some areas of the clayey Carlow soils on the lower parts of the landscape. Included soils make up about 5 percent of the unit.

Permeability is moderate in the Dockery soil, and surface runoff is slow. The available water capacity is high. A seasonal high water table is at a depth of 2 to 3 feet during most winter and spring months. The shrink-swell potential is moderate. Natural fertility is medium, and the organic matter content is moderate. The surface layer is friable and can be easily tilled after the soil dries out in the spring.

Most areas are used for cultivated crops or woodland. This soil is suited to soybeans, corn, and small grain. A drainage system is needed. Land grading can eliminate wet spots. Because of the stream channels, farm equipment cannot cross some areas.

This soil is moderately suited to reed canarygrass and alsike clover. It is poorly suited to crownvetch, lespedeza, and switchgrass and to hay. The wetness and the flooding are the main management problems. The grazing systems should accommodate the periods of flooding. Because of the wetness, maintaining stands of desirable species is difficult in depressional areas. A surface drainage system is beneficial, especially if the deeper rooted species are grown.

Many low areas support native timber. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the frequent flooding, this soil generally is unsuitable for building site development and onsite waste disposal.

The land capability classification is IVw. The woodland ordination symbol is 4A.

85—Carlow silty clay loam. This deep, nearly level, poorly drained soil is in the lower areas on the flood plains along the Mississippi River. It is protected by levees, but it is still subject to rare flooding because the levees can break and the soil can receive runoff from the adjacent areas. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is very dark grayish brown, firm silty clay loam about 10 inches thick. The subsoil to a depth of 60 inches or more is mottled, firm silty clay. It is dark grayish brown in the upper part and grayish brown in the lower part. In places the dark surface layer is less than 10 inches thick. In some areas the soil has overwash of brown silt loam.

Included with this soil in mapping are some areas of sandy soils on mounds and low ridges, a few areas of Portage soils on the lowest parts of the landscape, and a few areas of Dockery soils on low natural levees. Portage soils are more clayey than the Carlow soil, and Dockery soils are less clayey. Included soils make up about 10 percent of the unit.

Permeability is very slow in the Carlow soil. Surface runoff also is very slow. The available water capacity is moderate. Natural fertility is medium, and the organic matter content is moderate. The shrink-swell potential is high. A seasonal high water table is within a depth of 1 foot during most winter and spring months.

Most areas are used for cultivated crops (fig. 13). Some areas that are flooded late in the fall provide habitat for migratory waterfowl. This soil is suited to soybeans, corn, and small grain. A drainage system is needed. Land grading can eliminate wet spots.

This soil is moderately well suited to reed canarygrass. It is moderately suited to alsike clover, bluegrass, and redtop. It is poorly suited to hay. The wetness and the flooding are the main management problems. The grazing system should accommodate the periods of flooding. Because of the wetness, maintaining stands of desirable species in depressional areas is difficult. A surface drainage system is beneficial, especially if the deeper rooted species are grown.

Some low areas support native timber. This soil is suited to trees. The equipment limitation, the windthrow hazard, and seedling mortality are management concerns. Planting and harvesting equipment should be used only during periods when the soil is dry or frozen. The stands should be thinned less intensively and more frequently than the stands in areas where windthrow is less likely. The seedling mortality rate can be reduced by ridging the soil and then planting on the ridges.

Because of the rare flooding, this soil generally is unsuitable for building site development and onsite waste disposal.

The land capability classification is IIIw. The woodland ordination symbol is 6W.

86—Kampville silt loam. This deep, nearly level, somewhat poorly drained soil is on the flood plains along the Mississippi River and its tributaries. The soil is subject to rare flooding. Individual areas are irregular in shape and range from 10 to more than 100 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsoil is about 40 inches thick. It is mottled. It is dark grayish brown, friable silty clay loam in the upper part; dark grayish brown, firm silty clay in the next part; and grayish brown, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is grayish brown, mottled, firm silty clay loam. In some areas the surface layer is darker. In a few areas the subsoil contains less clay.

Included with this soil in mapping are a few areas of Carlow soils in narrow drainageways and a few small areas of Dupo soils on natural levees. Carlow soils are more clayey than the Kampville soil, and Dupo soils are much less clayey in the upper part. Included soils make up about 5 percent of the unit.

Permeability is moderately slow in the Kampville soil, and surface runoff is slow. The available water capacity is high. Natural fertility is medium, and the organic matter content is moderately low. The shrink-swell potential is high. A seasonal high water table is at a depth of 1 to 3 feet during most winter and spring months. The surface layer is friable and can be easily tilled.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, and small grain. A surface drainage system is needed in low areas.

This soil is suited to pasture and hay. It is well suited to reed canarygrass and moderately well suited to lespedeza, red clover, and tall fescue. It is moderately well suited to switchgrass and moderately suited to other warm-season grasses. The wetness is the main problem. A surface drainage system is beneficial, especially if deep-rooted species are grown. A good seedbed can be easily prepared.

This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

Because of the rare flooding, this soil generally is unsuitable for building site development and onsite waste disposal.

The land capability classification is IIw. The woodland ordination symbol is 9A.

91—Pits, quarries. This map unit is in areas where dolomitic limestone formerly was or currently is quarried.

Figure 13.—Corn in an area of Carlow silty clay loam. An area of the Menfro-Crider association is in the background.

It generally consists of the quarry pits, stockpiles of lime and crushed rock, and equipment and transport areas. Individual areas range from 5 to 50 acres in size.

Included in this unit in mapping are piles of overburden and clay pits. These included areas make up about 15 percent of the unit. They support vegetation, primarily small hardwoods, annual weeds, and perennial grasses.

The active quarry pits are dry, but some of the abandoned ones contain water. Detailed onsite investigation is needed to determine the suitable uses of the abandoned areas.

No land capability classification is assigned.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed,

forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban and built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal inputs of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 150,000 acres in the survey area, or nearly 37 percent of the total acreage, meets the requirements for prime farmland. The largest areas of prime farmland are in soil associations 2, 5, and 6, which are described under the heading "General Soil Map Units." The main crops grown on this land are corn and soybeans. An estimated 75 percent of the total cropland in the county is prime farmland.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures. The naturally wet soils in Lincoln County generally have been adequately drained through the application of drainage measures or the incidental drainage that results from farming or other kinds of land development.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Approximately 189,622 acres in the survey area, or 46.3 percent of the total acreage, was used for crops and pasture in 1984. Of this total, about 69,206 acres was used as permanent pasture or hayland. About 120,416 acres was used for cultivated crops, mainly corn, soybeans, sorghum, and wheat (*17*).

The potential of the soils in Lincoln County for sustained production of food is good. Only about 35 percent of the cropland and pasture is adequately treated for conservation purposes (*17*). Most of the inadequately treated cropland is in upland areas that are farmed in a manner that causes excessive erosion. Because of this excessive soil loss, crop production cannot be sustained for a long period. On most of the cropland, erosion can be held within tolerable limits by conservation practices designed for specific sites. Some of the marginal cropland used for row crops should be converted to pasture and hayland.

The main management concerns on the cropland and pasture in the county are water erosion, wetness and flooding, and fertility and tilth.

Water erosion is the major problem on sloping cropland and on overgrazed pastures. It is a hazard on all soils that have a slope of more than 2 percent.

Loss of the surface through erosion reduces productivity. It is especially damaging on soils that have a clayey subsoil, which is incorporated into the plow layer. Mexico, Keswick, Hatton, and Menfro soils are examples. Seedbed preparation and tillage are difficult in many fields that have clayey spots where the original friable surface soil has been eroded away. Erosion also reduces the productivity of soils that tend to be droughty and are shallow over bedrock, such as Gasconade and Ramsey soils.

Erosion on farmland results in sedimentation in streams, lakes, and ponds. Controlling erosion minimizes this pollution and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion-control measures provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that maintains a cover of

crops or crop residue can hold erosion losses to amounts that will not reduce the productive capacity of the soils. Growing grasses and legumes for pasture and hay is very effective in controlling erosion. When used in crop rotations, clover, alfalfa, and other legumes also improve tilth and provide nitrogen for the following crop.

Terraces reduce the length of slopes and thus the runoff rate and the hazard of erosion. Conventional terraces are most practical on upland soils that have long smooth slopes of less than 8 percent. Special construction and management techniques are necessary if terrace systems are to be effective in most areas of the strongly sloping Bucklick, Crider, Keswick, and Menfro soils. Grassed back-slope terraces reduce the gradient of the slopes. In contrast, conventional terraces increase the gradient. As a result, additional erosion-control measures are crucial.

On the strongly sloping soils, a cropping system that provides a substantial vegetative cover is needed unless erosion is controlled by a system of conservation tillage that leaves a large amount of crop residue on the surface. Minimizing tillage and leaving a large quantity of crop residue on the surface increase the rate of water infiltration and reduce the hazards of runoff and erosion. They can be effective on many of the soils in the county but are less effective on eroded soils that have a clayey surface layer. In some areas of Hatton, Keswick, and Mexico soils, special management is needed if terracing has exposed the clayey subsoil.

If the soil is not suitable for terracing, other erosion-control measures can be used. Contour stripcropping, for example, helps to control erosion through the use of contoured strips of permanent vegetation. These strips of grasses or grasses and legumes generally are harvested for hay. The areas between the strips are used for row crops, which are planted on the contour. A system of conservation tillage, such as no-till planting, is effective in controlling erosion on sloping soils. It is becoming more common in the county. It can be used on many of the soils. Special management is needed, however, in severely eroded areas where a system of conservation tillage is applied.

Wetness and *flood control* are management concerns on about 18 percent of the acreage used for crops and pasture in the county (fig. 14). Portage and Twomile soils are naturally so wet that crop production is reduced during some part of the year. Some land grading or a surface drainage system are needed on these soils. Occasional flooding can be a problem on Haymond and Kennebec soils. Flooding in the county commonly occurs during the period November through May.

Soil fertility is naturally lower in most of the eroded or shallow soils in the county than in other soils. On all of the soils, however, additional plant nutrients are needed before maximum production can be achieved. Most of the soils are naturally acid in the upper part of the root zone. As a result, applications of ground limestone are needed to raise the pH and calcium levels sufficiently for the optimum growth of legumes. On all of the soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the desired level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime to be applied.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. Most of the slightly eroded upland soils that are used for crops have a silt loam surface layer. Generally, the structure of these soils is weakened by tillage and compaction. A crust forms on the surface during periods of heavy rainfall. Because it is hard when dry, the crust reduces the rate of water infiltration and increases the runoff rate. Regularly adding crop residue, manure, and other organic material improves soil structure and tilth.

In all of the eroded upland soils in the county, the content of clay in the surface layer is higher than that in the surface layer of the uneroded soils. As a result, tilth is poorer, the infiltration rate is slower, and the runoff rate is more rapid. Conservation practices are needed to control further erosion.

Corn and soybeans are the best suited *field crops* in the county (fig. 15). In 1982, they were grown on about 106,000 acres. Grain sorghum was grown on about 4,800 acres, and wheat, the most common close-growing crop, was grown on about 35,000 acres (*5*). Oats and rye can be grown, and grass seed can be produced from bromegrass, fescue, and orchardgrass.

Pasture and hay crops suited to the soils and climate in the county include several legumes, cool-season grasses, and warm-season native grasses. Alfalfa and red clover are the most common legumes grown for hay. They are also included in mixtures with tall fescue, bromegrass, orchardgrass, or timothy grown for hay or pasture.

The warm-season native grasses adapted to the county are big bluestem, little bluestem, indiangrass, and switchgrass. These grasses grow well during the hot summer months. Their management requirements differ from those of cool-season grasses.

Alfalfa is best suited to deep, well drained soils, such as Bucklick, Crider, and Menfro soils. The other legumes and all of the grasses grow well on most of the upland soils. Water-tolerant species, such as lespedeza, orchardgrass, reed canarygrass, and tall fescue, should be selected for planting on Carlow, Portage, and Twomile soils.

The major management concerns in most of the pastured areas in the county are overgrazing and gully erosion. Controlled grazing is needed. Also, keeping grasses at a desirable height reduces the hazards of runoff and gully erosion.

Figure 14.—An area of the poorly drained Carlow soils used for soybeans. A surface drainage system is needed.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops,

Figure 15.—Corn and soybeans on Haymond and Moniteau soils. An area of the Keswick-Hatton association is in the background.

the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*15*). Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

There are no class I, class V, or class VIII soils in Lincoln County.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, or s,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony.

The capability classification of each map unit, except for Pits, quarries, is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

James L. Robinson, forester, Soil Conservation Service, helped prepare this section.

Approximately 26 percent of Lincoln County is forested (*17*). The primary forest cover type is oak-hickory. White oak, northern red oak, black oak, post oak, and hickory are the major species. Sugar maple is the most common species on some sites. This species may be a problem affecting the regeneration of oak-hickory forests after the existing stands are harvested.

Most of the upland forest is in areas of the Goss-Gasconade-Brussels and Keswick-Hatton soil associations, which are described under the heading "General Soil Map Units." These associations are moderately productive when they are used for timber. The potential productivity of the Gasconade soils is limited. These soils support almost pure stands of eastern redcedar or a mixture of white ash, low-grade oak, and hickory. The Keswick soils in the steeper areas of the Mexico-Keswick association support similar forest species. The Mexico soils formed under prairie vegetation and typically do not support timber.

The most productive upland sites tend to be in areas of the deep soils in the Menfro-Crider association. The major timber species on these soils commonly are white oak, northern red oak, and scattered black walnut. The better quality oaks generally grow on the north- and east-facing slopes. The poorer quality oaks and a greater number of such species as white ash grow on the drier ridges and on south-facing slopes.

The Portage-Carlow-Dockery and Haymond-Moniteau associations on bottom land are intensively farmed. Forest stands are along stream corridors, in low areas that are frequently flooded, and in other small areas. Adapted bottom-land species are highly productive on these soils. Cottonwood, black willow, silver maple, green ash, and American sycamore are the most common species. The Haymond soils in the Haymond-Moniteau association and Kennebec soils, which are of minor extent in this association, are excellent sites for black walnut.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of coarse fragments in the soil; and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A

rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees may be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. It applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service, the Missouri Department of Conservation, or the Cooperative Extension Service or from a commercial nursery.

Recreation

Edward A. Gaskins, biologist, Soil Conservation Service, helped prepare this section.

Lincoln County has many commercial and public recreational facilities. Most towns have parks used for

sports and picnicking. The rivers provide opportunities for boating and fishing. The county has a state park, which is more than 6,000 acres in size. This park provides opportunities for camping, hiking, nature observation, swimming, and fishing. Several wildlife areas are used for hunting and fishing.

In 1980, a total of 12,997 acres in Lincoln County was developed for recreational uses (fig. 16). Ownership of these areas is about 88 percent state, 8 percent private, and 4 percent municipal, federal, school, and other. The facilities include river sports areas, swimming pools, hunting and fishing areas, campgrounds, ballfields, playgrounds, game courts, picnic areas, historical sites, fairgrounds, horse and hiking trails, and wildlife-viewing areas (*12*).

In 1982, the county had 13 public recreational areas more than 100 acres in size (*12*). These are a state park, a state forest, six wildlife areas, and various fishing lakes and campgrounds. City parks and access areas for fishing also are available to the general public. Federally owned islands in the Mississippi River are commonly used for recreational activities.

In 1974, the county had 29 private and semiprivate commercial recreation enterprises (*10*). It currently has about 20 of these enterprises, including fishing lakes, gun clubs, boat-rental areas, marinas, shooting preserves, campgrounds, and hunting and beagle clubs. The priority recreational needs in the county are those for additional campgrounds and public hunting areas.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for

Figure 16.—A wooded area of Dockery silty clay loam developed for recreational uses.

recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Edward A. Gaskins, biologist, Soil Conservation Service, helped in the preparation of this section.

Lincoln County is among the 21 counties that make up the Northeast Riverbreaks Zoogeographic Region in Missouri (*9*). A transition zone between the prairie and the Ozark Border, this region has rich and varied land types, which provide a variety and profusion of excellent wildlife cover. Originally, the county was covered with a mixture of woodland and prairie vegetation. Currently, about 50 percent of the land area is cultivated cropland, 24 percent is grassland, and 26 percent is woodland.

In 1972, about 79,400 acres of woodland in the county was commercial forest land (*3*). The county currently has approximately 118,000 acres of woodland wildlife habitat. This acreage includes areas that support the smaller woody species, such as shrubs and brush. The Goss-Gasconade-Brussels soil association, which is described under the heading "General Soil Map Units," is the only association in the county that supports dominantly woodland vegetation. Some areas of the other associations also provide habitat for woodland wildlife.

The deer population in the county is fair or good. The carrying capacity for this game animal has not yet been reached. The turkey population is excellent. The carrying capacity for this species has been reached.

The squirrel population is excellent. The resident woodcock population is good, but it presently attracts few, if any, hunters. Ruffed grouse have been observed on rare occasions in the southwestern part of the county.

The furbearer population is very good or excellent. Increases in the value of fur have resulted in heavy hunting and trapping pressure during the past several years. Raccoon, muskrat, opossum, coyote, mink, striped skunk, beaver, and gray fox are the principal species trapped in the county.

The cropland and grassland in the county is mainly in areas of the Keswick-Hatton, Mexico-Keswick, Menfro-Crider, Portage-Carlow-Dockery, and Haymond-Moniteau associations. These areas provide habitat for openland habitat. Corn, soybeans, and wheat are the principal grain crops grown in the county. Much of the original

grassland has been converted to cropland, and herbaceous vegetation appears to be the most scarce of the different habitat cover types. Increases in the size of fields and the loss of wooded travel lanes extending into areas of cropland are having a detrimental effect on the openland wildlife in the county.

The quail population is nearly excellent. The rabbit population is excellent. The resident dove population is fair. It is augmented each year by migratory flights. The songbird population is good throughout the county.

No original prairie areas remain in the county. The marsh hawk is the only prairie species that currently inhabits the county. One area along the Mississippi River has an excellent population of bald eagles. About 70 to 100 of these birds overwinter in this area.

Nearly all of the wetland wildlife habitat and waterfowl-hunting areas in the county are in the Portage-Carlow-Dockery association, which is on the bottom land along the Mississippi River. The county once provided excellent opportunities for hunting waterfowl, but the number of geese and ducks presently is low. Mallards and teal frequent farm ponds, and wood ducks frequent the Cuivre River and Big, Lead, and Sugar Creeks. Wetland habitat is by far the most scarce of the three broad habitat types.

Fishing opportunities are provided by rivers, streams, lakes, and farm ponds. The county has 121 miles of permanently flowing streams (*6*). The Mississippi River, which borders the county for 35 miles, is subject to heavy fishing pressure. Commercial fishermen catch primarily carp, buffalofish, channel catfish, and flathead catfish. Sportsmen catch mainly white bass, walleye, channel catfish, largemouth bass, suckers, paddlefish, and crappie.

The better fishing rivers are the Cuivre River and its north and west forks. Lead, Sugar, and Big Creeks also are subject to heavy fishing pressure. The principal stream fish include channel catfish, flathead catfish, largemouth bass, smallmouth bass, white bass, crappie, drum, carp, bluegill, and green sunfish.

Opportunities for impoundment fishing are limited in the county. The Cuivre River State Park Lake and several smaller lakes in the state-owned wildlife areas are the only lakes open to the public. The county has more than 1,500 farm ponds and small lakes. Most of these ponds and lakes have been stocked with a combination of largemouth bass, channel catfish, and bluegill.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are soybeans, wheat, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bluegrass, indiangrass, switchgrass, orchardgrass, alfalfa, birdsfoot trefoil, and crownvetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, foxtail, croton, and partridge pea.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of

hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, sumac, cherry, apple, hawthorn, dogwood, hickory, blackberry, persimmon, and sassafras. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are wild plum, hazelnut, Amur honeysuckle, autumn-olive, and crabapple.

Coniferous plants furnish winter cover, browse, and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, cutgrass, cattail, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl-feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, mourning dove, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and shrink-swell potential can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath

the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 foot or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or

many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to

bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

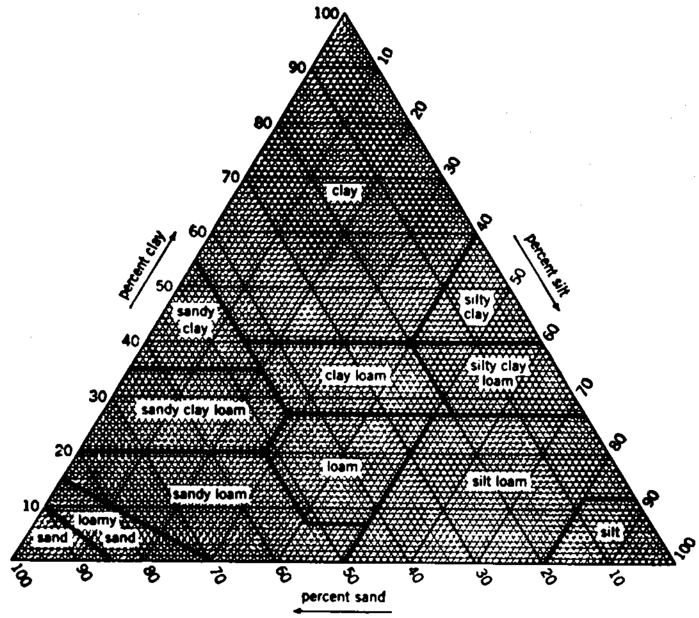

Figure 17.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 17). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "cherty." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of

grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to

buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*16*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, montmorillonitic, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*14*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*16*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Brevator Series

The Brevator series consists of deep, well drained soils on uplands. These soils formed in local pedisediments and glacial material. Permeability is moderately slow. Slopes range from 14 to 30 percent.

Brevator soils are similar to Keswick soils and commonly are adjacent to Keswick and Mexico soils. Keswick soils have mottles with chroma of 2 or less in the upper part of the B horizon. Mexico soils dominantly have chroma of 2 or less and have less sand throughout the B horizon than the Brevator soils. They are in the higher positions on the landscape.

Typical pedon of Brevator loam, 14 to 30 percent slopes, 600 feet north and 1,400 feet east of the southwest corner of sec. 35, T. 48 N., R. 1 W., UTM coordinates 4,304,430 meters N., 674,243 meters E.

Ap—0 to 5 inches; brown (10YR 5/3) loam, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; few fine roots; slightly acid; clear smooth boundary.

E—5 to 13 inches; brown (10YR 5/3) cherty loam; weak very fine granular structure; very friable; few fine roots; about 25 percent chert fragments; medium acid; clear smooth boundary.

2Bt1—13 to 17 inches; red (2.5YR 4/6) clay; moderate fine subangular blocky structure; firm; few fine roots; common faint clay films; few rounded pebbles; common sand grains; strongly acid; clear smooth boundary.

2Bt2—17 to 30 inches; strong brown (7.5YR 5/6) clay; moderate fine subangular blocky structure; firm; few very fine roots; common faint clay films; few rounded pebbles; common sand grains; strongly acid; clear smooth boundary.

2Bt3—30 to 45 inches; yellowish brown (10YR 5/6) silty clay; weak fine subangular blocky structure; firm; few faint clay films; few rounded pebbles; few sand grains; medium acid; gradual smooth boundary.

2C—45 to 60 inches; yellowish brown (10YR 5/6) silty clay; massive; firm; common rounded pebbles; common sand grains; medium acid.

The thickness of the solum ranges from 40 to 60 inches. Scattered glacial pebbles commonly are throughout the profile, but they do not occur in the A horizon in some pedons. A stone line is near the top of or directly above the Bt1 horizon.

The A horizon generally has value of 4 or 5 and chroma of 2 or 3. In some pedons, however, it has value of 3 and chroma of 1 to 3 and is less than 6 inches thick. The E horizon is loam, silt loam, or the cherty analogs of these textures. It has value of 4 or 5 and chroma of 2 to 4. Some pedons do not have an E horizon. The Bt horizon has hue of 2.5YR to 10YR, value of 4 to 6, and chroma of 4 to 8. It is clay, silty clay, or clay loam. The content of clay in the upper 20 inches of this horizon ranges from 35 to 50 percent.

Brussels Series

The Brussels series consists of deep, well drained soils on uplands. These soils formed in limestone residuum and in colluvium. Permeability is moderately slow. Slopes range from 14 to 70 percent.

Brussels soils commonly are adjacent to Bucklick, Gasconade, and Goss soils. Bucklick soils are redder throughout than the Brussels soils. Also, they are lower on the landscape. Gasconade and Goss soils are in the higher positions on the landscape. Gasconade soils are less than 20 inches deep over bedrock. Goss soils have a surface layer that is lighter colored than that of the Brussels soils and are cherty throughout.

Typical pedon of Brussels very flaggy silty clay loam, in an area of Goss-Gasconade-Brussels complex, 9 to 70 percent slopes, 1,800 feet south and 100 feet west of the northeast corner of sec. 10, T. 49 N., R. 1 W., UTM coordinates 4,321,500 meters N., 673,878 meters E.

A—0 to 5 inches; black (10YR 2/1) very flaggy silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine granular structure; firm; many fine roots; about 35 percent flagstones of limestone; mildly alkaline; clear smooth boundary.

Bw1—5 to 15 inches; very dark grayish brown (10YR 3/2) very flaggy silty clay, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; firm; many fine roots; about 35 percent flagstones of limestone; mildly alkaline; gradual smooth boundary.

Bw2—15 to 35 inches; dark brown (10YR 4/3) very flaggy silty clay; moderate fine subangular blocky structure; firm; common fine roots; about 40 percent flagstones of limestone; mildly alkaline; gradual smooth boundary.

Bw3—35 to 60 inches; brown (7.5YR 4/4) very flaggy silty clay loam; weak fine subangular blocky structure; firm; common fine roots; about 40 percent flagstones of limestone; mildly alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The content of limestone fragments ranges from 35 to 70 percent. The depth to bedrock is more than 40 inches. The content of clay in the control section ranges from 35 to 50 percent. The mollic epipedon is 10 to 24 inches thick.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 to 6. Where chroma is 2, value is 3.

Bucklick Series

The Bucklick series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in a thin mantle of loess and in the underlying material weathered from thinly interbedded dolomite or limestone and shale. Slopes range from 5 to 20 percent.

Bucklick soils commonly are adjacent to Crider, Gasconade, and Keswick soils. Crider soils are not so red in the upper part of the Bt horizon as the Bucklick soils. Also, they are higher on the landscape. Gasconade soils are less than 20 inches deep over bedrock. They are lower on the landscape than the Bucklick soils. Keswick soils have rounded sand grains and pebbles in the Bt horizon. They are higher on the landscape than the Bucklick soils.

Typical pedon of Bucklick silty clay loam, 5 to 9 percent slopes, eroded, 480 feet south and 1,730 feet west of the northeast corner of sec. 24, T. 49 N., R. 1 E., UTM coordinates 4,319,680 meters N., 676,580 meters E.

Ap—0 to 6 inches; dark brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few fine roots; neutral; abrupt smooth boundary.
Bt1—6 to 14 inches; dark brown (7.5YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; common faint clay films on faces of peds; few fine roots; medium acid; clear smooth boundary.
Bt2—14 to 22 inches; yellowish red (5YR 4/6) silty clay; moderate fine subangular blocky structure; firm; common distinct clay films on faces of peds; few chert fragments; few fine roots; medium acid; clear smooth boundary.
Bt3—22 to 56 inches; yellowish red (5YR 4/6) silty clay; moderate fine subangular blocky structure; firm; few faint clay films on faces of peds; few chert fragments; few fine roots; strongly acid; gradual smooth boundary.
R—56 inches; hard limestone bedrock.

The thickness of the solum and the depth to bedrock range from 40 to 60 inches. The A horizon has hue of 7.5YR or 10YR and chroma of 2 to 4. It is silt loam or silty clay loam. The Bt horizon has hue of 5YR or 7.5YR in the upper part and hue of 2.5YR or 5YR in the lower part. It is silty clay, silty clay loam, cherty silty clay, or cherty silty clay loam.

Carlow Series

The Carlow series consists of deep, poorly drained soils on the flood plains along the Mississippi River. These soils formed in clayey alluvium. Permeability is very slow. Slopes range from 0 to 2 percent.

Carlow soils commonly are adjacent to Dockery, Kampville, and Portage soils. Dockery soils have less clay than the Carlow soils. Also, they are slightly higher on the landscape. Kampville soils have less clay than the Carlow soils and have a lighter colored surface layer. They are in landscape positions similar to those of the Carlow soils. Portage soils are in the slightly lower landscape positions. The content of clay in these soils is more than 60 percent.

Typical pedon of Carlow silty clay loam, 1,250 feet west and 4,100 feet south of the northeast corner of sec. 5, T. 48 N., R. 3 E., UTM 4,313,050 meters N., 698,760 meters E.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine granular structure; firm; many fine roots; medium acid; abrupt smooth boundary.
Bg1—10 to 16 inches; dark grayish brown (10YR 4/2) silty clay; common fine prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; common shiny pressure faces on peds; common fine roots; strongly acid; clear smooth boundary.
Bg2—16 to 47 inches; dark grayish brown (10YR 4/2) silty clay; common fine prominent strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; firm; many shiny pressure faces on peds; few fine roots; strongly acid; clear smooth boundary.
Bg3—47 to 60 inches; grayish brown (10YR 5/2) silty clay; common medium prominent strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; firm; many shiny pressure faces on peds; few fine black concretions; strongly acid.

The thickness of the solum ranges from 30 to more than 60 inches. The mollic epipedon is 10 to 20 inches thick. The control section typically is silty clay in which the content of clay is 45 to 60 percent.

The A horizon has value of 2 or 3 and chroma of 2 or less. It typically is silty clay loam, but in some pedons it is silty clay. The B and C horizons have value of 4 to 6 and chroma of 2 or less and have brightly colored mottles.

Cedargap Series

The Cedargap series consists of deep, well drained soils on flood plains along small streams. These soils formed in recent alluvium eroded mainly from nearby upland soils that are underlain by cherty limestone. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

Cedargap soils commonly are adjacent to Dameron and Haymond soils. The adjacent soils are in positions on the landscape similar to those of the Cedargap soils. Dameron soils have less chert in the upper 10 to 30 inches than the Cedargap soils. Haymond soils are brownish throughout and have no chert.

Typical pedon of Cedargap silt loam, 600 feet north and 2,400 feet west of the southeast corner of sec. 11, T. 49 N., R. 3 W., UTM coordinates 654,520 meters E., 4,320,580 meters N.

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; very friable; few fine roots; about 2 percent coarse fragments; neutral; clear smooth boundary.
A2—8 to 32 inches; very dark grayish brown (10YR 3/2) very cherty silt loam; weak very fine subangular blocky structure; very friable; few fine roots; about 35 percent coarse fragments; neutral; gradual smooth boundary.

C—32 to 60 inches; very dark grayish brown (10YR 3/2) extremely cherty loam; massive; very friable; about 75 percent coarse fragments; neutral.

The thickness of the solum ranges from 24 to 44 inches. The organic matter content decreases irregularly with increasing depth. The content of chert increases with increasing depth.

The A horizon has value and chroma of 2 or 3. It is silt loam, loam, or the cherty or very cherty analogs of these textures. The C horizon has hue of 7.5YR or 10YR, value of 2 to 6, and chroma of 2 to 4. It is the very cherty or extremely cherty analogs of loam or silt loam.

Crider Series

The Crider series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess and in the underlying limestone residuum. Slopes range from 5 to 20 percent.

Crider soils are similar to Menfro soils and commonly are adjacent to Bucklick, Gasconade, and Menfro soils. Bucklick soils are lower on the landscape than the Crider soils. Also, they are redder. The content of clay in the upper part of their Bt horizon is more than 35 percent. Gasconade soils are shallow over bedrock. They are on the lower side slopes. Menfro soils do not have a reddish 2Bt horizon.

Typical pedon of Crider silt loam, 5 to 9 percent slopes, eroded, 30 feet south and 2,200 feet west of the northeast corner of sec. 24, T. 49 N., R. 1 W., UTM coordinates 4,318,840 meters N., 676,440 meters E.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

Bt1—7 to 13 inches; dark brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—13 to 26 inches; dark brown (7.5YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; few pale brown (10YR 6/3) silt coatings; medium acid; clear smooth boundary.

2Bt3—26 to 35 inches; reddish brown (5YR 4/4) silty clay loam; moderate fine subangular blocky structure; firm; common distinct clay films on faces of peds; few pale brown (10YR 6/3) silt coatings; strongly acid; gradual smooth boundary.

2Bt4—35 to 60 inches; reddish brown (5YR 4/4) silty clay loam; weak fine subangular blocky structure; firm; few faint clay films on faces of peds; strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The Ap horizon has hue of 7.5YR or 10YR and chroma of 3 or 4. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam. The 2B horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or silty clay. The content of chert fragments in this horizon ranges from 0 to 15 percent.

Dameron Series

The Dameron series consists of deep, well drained soils on flood plains along small streams. These soils formed in recent alluvium eroded mainly from nearby upland soils underlain by cherty limestone. Permeability is moderate in the upper part of the profile and moderately rapid in the lower part. Slopes range from 0 to 2 percent.

Dameron soils commonly are adjacent to Cedargap and Haymond soils. The adjacent soils are in landscape positions similar to those of the Dameron soils. Cedargap soils have more chert in the upper 10 to 30 inches than the Dameron soils. Haymond soils have no chert.

Typical pedon of Dameron silt loam, 550 feet east and 1,000 feet south of the northwest corner of sec. 22, T. 49 N., R. 2 W., UTM coordinates 662,110 meters E., 4,318,690 meters N.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure; very friable; common very fine roots; neutral; clear smooth boundary.

A—8 to 28 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak very fine subangular blocky structure; very friable; few fine roots; about 2 percent chert fragments; neutral; clear wavy boundary.

2C—28 to 60 inches; dark brown (10YR 4/3) very cherty silty clay loam; massive; friable; about 50 percent chert fragments, 10 percent more than 3 inches in size; neutral.

The mollic epipedon and the solum are less than 36 inches thick. The A horizon has chroma of 2 or 3. The 2C horizon has value and chroma of 3 or 4. It is the cherty or very cherty analogs of silty clay loam.

Dockery Series

The Dockery series consists of deep, somewhat poorly drained, moderately permeable soils on the flood plains along the Mississippi River. These soils formed in acid, silty alluvium. Slopes range from 0 to 2 percent.

Dockery soils commonly are adjacent to Carlow, Kampville, and Portage soils. Carlow soils have more clay than the Dockery soils. Also, they are slightly lower on the landscape. Kampville soils have a light colored

surface layer. They are in the slightly higher positions on the landscape. Portage soils are in the lower positions. The content of clay in these soils is more than 60 percent.

Typical pedon of Dockery silty clay loam, 1,100 feet south and 2,675 feet east of the northwest corner of sec. 7, T. 49 N., R. 3 E., UTM coordinates 4,322,290 meters N., 697,780 meters E.

A—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; firm; few fine roots; slightly acid; clear smooth boundary.

C1—10 to 24 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; thin lenses of dark brown (10YR 3/3) silt loam; weak fine subangular blocky structure; firm; few fine roots; slightly acid; gradual smooth boundary.

C2—24 to 42 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; thin lenses of dark brown (10YR 3/3) silt loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak thin platy structure; firm; few fine roots; slightly acid; gradual smooth boundary.

Cg—42 to 60 inches; dark grayish brown (10YR 4/2) silt loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; massive; friable; slightly acid.

The A horizon has value of 2 or 3 and chroma of 2 or less. Some pedons have overwash of brown silt loam. In the 10- to 40-inch control section, the content of clay is 27 to 35 percent and the texture is silty clay loam or silt loam.

The C and Cg horizons have value of 3 to 5 and chroma of 2 or less. They are silty clay loam, silt loam, or clay loam.

Dupo Series

The Dupo series consists of deep, somewhat poorly drained, slowly permeable soils on flood plains. These soils formed in recent silty alluvium 20 to 40 inches deep over a dark, clayey buried soil. Slopes range from 0 to 2 percent.

Dupo soils commonly are adjacent to Haymond and Portage soils. Haymond soils are silty throughout. They typically are nearer to the uplands than the Dupo soils. Portage soils are clayey throughout. They are nearer to the main river channels than the Dupo soils.

Typical pedon of Dupo silt loam, 1,900 feet east and 900 feet north of the intersection of Highway M and the Burlington Northern Railroad; UTM coordinates 694,460 meters E., 4,332,100 meters N.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; very friable; few fine roots; neutral; abrupt smooth boundary.

C1—8 to 19 inches; dark brown (10YR 4/3) silt loam; few fine distinct dark yellowish brown (10YR 4/6) mottles; weak very fine subangular blocky structure; very friable; few thin silt coatings; few worm casts; few fine roots; neutral; clear smooth boundary.

C2—19 to 26 inches; dark brown (10YR 4/3) silt loam; common fine distinct dark yellowish brown (10YR 4/6) and few fine faint dark grayish brown (10YR 4/2) mottles; massive; very friable; common black stains; few thin silt coatings; few worm casts; few fine roots; neutral; abrupt smooth boundary.

2Ab—26 to 38 inches; very dark gray (10YR 3/1) clay; moderate fine subangular blocky structure; firm; few fine roots; neutral; clear smooth boundary.

2C—38 to 60 inches; dark gray (10YR 4/1) clay; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; firm; neutral.

The depth to the 2Ab horizon ranges from 20 to 40 inches. The Ap horizon has chroma of 2 or 3. The C horizon has value of 4 or 5 and chroma of 2 or 3. The Ab horizon has value of 2 or 3 and chroma of 1 or 2. It is silty clay loam, silty clay, or clay. The 2C horizon has value of 4 or 5. It is clay or silty clay.

Gasconade Series

The Gasconade series consists of shallow, somewhat excessively drained soils on uplands. These soils formed in limestone residuum. Permeability is moderately slow. Slopes range from 9 to 70 percent.

Gasconade soils commonly are adjacent to Brussels, Bucklick, and Goss soils. Brussels soils are more than 60 inches deep over bedrock. They typically are at the lower elevations. Bucklick soils are more than 40 inches deep over bedrock and have a B horizon that is redder than that of the Gasconade soils. They are at the lower elevations. Goss soils are more than 60 inches deep over bedrock and are cherty throughout. They are at the higher elevations.

Typical pedon of Gasconade very flaggy silty clay loam, in an area of Goss-Gasconade-Brussels complex, 9 to 70 percent slopes, 1,850 feet west and 600 feet south of the northeast corner of sec. 25, T. 48 N., R. 2 W., UTM coordinates 4,307,330 meters N., 666,040 meters E.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) very flaggy silty clay loam, dark grayish brown (10YR 4/2) dry; weak very fine granular structure; friable; about 50 percent limestone fragments; neutral; clear smooth boundary.

Bw—4 to 13 inches; very dark grayish brown (10YR 3/2) very flaggy silty clay; weak very fine subangular blocky structure; firm; about 40 percent limestone fragments; neutral; clear smooth boundary.

R—13 inches; limestone bedrock.

The thickness of the solum ranges from 4 to 20 inches. It is the same as the depth to bedrock. The content of coarse fragments ranges from 35 to 60 percent in the solum.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The B horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 to 4. It is very flaggy silty clay loam or very flaggy silty clay.

Goss Series

The Goss series consists of deep, well drained, moderately permeable cherty soils on uplands. These soils formed in material weathered from cherty dolomite interbedded with shale. Slopes range from 9 to 50 percent.

Goss soils commonly are adjacent to Crider, Gasconade, and Hatton soils. Crider and Gasconade soils are lower on the landscape than the Goss soils. The content of chert in Crider soils is less than 15 percent. Gasconade soils are less than 20 inches deep over bedrock. Hatton soils have no chert. They are at the higher elevations.

Typical pedon of Goss cherty silt loam, 14 to 50 percent slopes, 700 feet west and 2,700 feet north of the southeast corner of sec. 28, T. 48 N., R. 1 W., UTM coordinates 4,306,720 meters N., 672,010 meters E.

A—0 to 7 inches; dark brown (10YR 4/3) cherty silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; common fine roots; about 30 percent chert fragments; slightly acid; clear smooth boundary.

E—7 to 16 inches; yellowish brown (10YR 5/4) very cherty silty clay loam; weak fine granular structure; friable; few fine roots; about 40 percent chert fragments; medium acid; clear smooth boundary.

Bt1—16 to 42 inches; red (2.5YR 4/6) very cherty silty clay; weak very fine subangular blocky structure; firm; few fine roots; about 55 percent chert fragments; few faint clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—42 to 60 inches; red (2.5YR 4/6) very cherty clay; weak very fine subangular blocky structure; firm; about 55 percent chert fragments; few faint clay films on faces of peds; strongly acid.

The thickness of the solum and the depth to bedrock are more than 60 inches. The A horizon has value of 3 or 4 and chroma of 2 to 4. The content of chert in this horizon ranges from about 10 to 50 percent. The E horizon has value of 5 or 6 and chroma of 3 or 4. The Bt horizon has hue of 2.5YR to 7.5YR, value of 4 or 5, and chroma of 4 to 6. The content of chert in this horizon ranges from about 40 to 80 percent.

Hatton Series

The Hatton series consists of deep, moderately well drained soils on uplands. These soils formed in loess and in the underlying glacial sediments. Permeability is very slow. Slopes range from 2 to 9 percent.

Hatton soils are similar to Weller soils and commonly are adjacent to Keswick, Menfro, and Mexico soils. Keswick soils have more glacial sand and pebbles than the Hatton soils. Also, they are lower on the landscape. Menfro soils have less clay than the Hatton soils and do not have glacial sand and pebbles in the lower part. They are in landscape positions similar to those of the Hatton soils. Mexico soils have a dark surface layer and have more clay than the Hatton soils. Also, they are higher on the landscape. Weller soils have mottles with chroma of 2 in the upper part of the B horizon.

Typical pedon of Hatton silt loam, 5 to 9 percent slopes, 800 feet north and 100 feet east of the southwest corner of sec. 24, T. 48 N., R. 2 W., UTM coordinates 4,307,770 meters N., 665,500 meters E.

A—0 to 4 inches; dark brown (10YR 3/3) silt loam, pale brown (10YR 6/3) dry; moderate very fine granular structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.

E—4 to 14 inches; yellowish brown (10YR 5/4) silt loam; weak very fine granular structure; very friable; few fine roots; strongly acid; clear smooth boundary.

Bt1—14 to 20 inches; yellowish brown (10YR 5/4) silty clay; moderate very fine subangular blocky structure; firm; few fine roots; many prominent clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—20 to 26 inches; yellowish brown (10YR 5/4) silty clay; few fine faint dark yellowish brown (10YR 4/4) mottles; moderate very fine subangular blocky structure; firm; few fine roots; many prominent clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt3—26 to 32 inches; dark yellowish brown (10YR 4/4) silty clay; common fine distinct yellowish brown (10YR 5/8) mottles; moderate very fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

2Bx—32 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; common fine faint light brownish gray (10YR 6/2) mottles; massive; firm; few faint clay films on faces of peds; common sand grains and pebbles; very strongly acid.

The thickness of the solum ranges from 30 to more than 60 inches. The depth to weathered glacial till ranges from 27 to 38 inches.

The A horizon has value of 3 to 5 and chroma of 2 or 3. The E horizon has value of 5 or 6 and chroma of 3 or

4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. In some pedons it has reddish mottles. It is silty clay loam or silty clay. The content of clay in the upper 20 inches of the argillic horizon ranges from 35 to 48 percent. The 2Bx horizon is clay loam or silty clay loam.

Haymond Series

The Haymond series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium eroded mainly from the nearby loess-covered uplands. Slopes range from 0 to 2 percent.

Haymond soils commonly are adjacent to Cedargap, Dameron, Kennebec, and Moniteau soils. Cedargap and Dameron soils have an A horizon that is darker than that of the Haymond soils and have a cherty C horizon. They are in positions on the landscape similar to those of the Haymond soils. Kennebec soils have a mollic epipedon and have more clay than the Haymond soils. They are in the higher positions on the landscape. Moniteau soils are grayer than the Haymond soils and have more clay. They are on low stream terraces.

Typical pedon of Haymond silt loam, 3,225 feet east and 2,025 feet north of the intersection of Missouri Highways JJ and 79, UTM coordinates 4,337,260 meters N., 692,900 meters E.

Ap—0 to 11 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; very friable; common worm casts; few very fine roots; slightly acid; clear smooth boundary.

C1—11 to 26 inches; brown (10YR 4/3) silt loam; weak very fine subangular blocky structure; very friable; common worm casts; slightly acid; clear smooth boundary.

C2—26 to 50 inches; brown (10YR 4/3) silt loam; appears massive but has weak bedding planes; friable; common worm casts; slightly acid; clear smooth boundary.

C3—50 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct strong brown (7.5YR 4/6) mottles; appears massive but has weak bedding planes; friable; slightly acid.

The A horizon has value of 4 or 5 and chroma of 2 to 4. The C horizon has value of 4 or 5 and chroma of 3 or 4. In some pedons the content of coarse fragments in this horizon is 1 to 5 percent. The content of clay in the 10- to 40-inch control section ranges from 10 to 18 percent.

Kampville Series

The Kampville series consists of deep, somewhat poorly drained soils on flood plains. These soils formed in acid alluvium. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Kampville soils commonly are adjacent to Carlow and Dockery soils. The adjacent soils are in landscape positions similar to those of the Kampville soils. Carlow soils have a mollic epipedon. Dockery soils contain less clay than the Kampville soils.

Typical pedon of Kampville silt loam, 2,700 feet east and 2,400 feet south of the northwest corner of sec. 18, T. 48 N., R. 3 W., UTM coordinates 4,309,500 meters N., 697,720 meters E.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; few very fine roots; slightly acid; abrupt smooth boundary.

Btg1—8 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; friable; common pale brown (10YR 6/3) silt coatings and few faint clay films on faces of peds; strongly acid; clear smooth boundary.

Btg2—18 to 30 inches; dark grayish brown (10YR 4/2) silty clay; common fine distinct strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few distinct clay films on faces of peds; strongly acid; clear smooth boundary.

Btg3—30 to 48 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; firm; few faint clay films on faces of peds; strongly acid; gradual smooth boundary.

Cg—48 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct strong brown (7.5YR 4/6) mottles; massive; firm; few faint clay films in pores; medium acid.

The thickness of the solum ranges from 35 to 55 inches. The Ap horizon has chroma of 2 or 3. Some pedons have an E horizon. The Btg horizon has value of 4 or 5. It is silty clay loam or silty clay. The content of clay in the control section ranges from 35 to 48 percent.

Kennebec Series

The Kennebec series consists of deep, moderately well drained, moderately permeable soils on flood plains along tributaries of the Mississippi River. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Kennebec soils commonly are adjacent to Haymond and Moniteau soils. Haymond soils have less clay than the Kennebec soils and do not have a mollic epipedon. They are in landscape positions similar to those of the Kennebec soils. Moniteau soils are poorly drained and are slightly higher on the landscape than the Kennebec soils. They do not have a mollic epipedon.

Typical pedon of Kennebec silt loam, 2,900 feet south and 400 feet west of the intersection of the Pike-Lincoln County line and Missouri Highway 79, UTM coordinates 689,677 meters E., 4,342,900 meters N.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; very friable; few fine roots; neutral; abrupt smooth boundary.

A1—9 to 18 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; moderate very fine granular structure; friable; few fine roots; neutral; clear smooth boundary.

A2—18 to 26 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; friable; few fine roots; neutral; clear smooth boundary.

C1—26 to 34 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine faint dark yellowish brown (10YR 4/6) mottles; massive; friable; slightly acid; clear smooth boundary.

C2—34 to 60 inches; grayish brown (10YR 5/2) silt loam; common fine faint dark yellowish brown (10YR 4/6) mottles; massive; very friable; common silt coatings on faces of peds; slightly acid.

The thickness of the solum ranges from 24 to 36 inches. The content of clay in the particle-size control section ranges from 18 to 30 percent. The A horizon has value of 2 or 3 and chroma of 1 or 2. It is silt loam or silty clay loam. The C horizon has value of 4 or 5.

Keswick Series

The Keswick series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in loess and glacial till. Slopes range from 5 to 14 percent.

Keswick soils are similar to Brevator soils and commonly are adjacent to Bucklick, Brevator, Goss, and Mexico soils. Brevator, Bucklick, and Goss soils do not have mottles with chroma of 2 or less. Bucklick and Goss soils are lower on the landscape than the Keswick soils. Bucklick soils do not have glacial material. Goss soils are cherty throughout. Mexico soils have a dark surface layer and contain less sand in the upper 30 inches than the Keswick soils. They are on the tops of the higher ridges.

Typical pedon of Keswick silt loam, 5 to 9 percent slopes, eroded, 1,700 feet north and 50 feet west of the southeast corner of sec. 20, T. 48 N., R. 1 E., UTM coordinates 680,265 meters E., 4,308,000 meters N.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam, yellowish brown (10YR 5/4) dry; weak very fine subangular blocky structure; very friable; few fine roots; neutral; abrupt smooth boundary.

2Bt1—7 to 11 inches; yellowish red (5YR 4/6) clay; moderate very fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; slightly acid; clear smooth boundary.

2Bt2—11 to 22 inches; yellowish red (5YR 4/6) clay; common fine prominent brown (10YR 4/3) mottles; moderate very fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

2Bt3—22 to 33 inches; dark brown (7.5YR 4/4) clay; common medium distinct yellowish red (5YR 4/6) and grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; very strongly acid; clear smooth boundary.

2Bt4—33 to 48 inches; strong brown (7.5YR 4/6) and grayish brown (10YR 5/2) clay; common fine prominent dark red (2.5YR 3/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; very strongly acid; clear smooth boundary.

2C—48 to 60 inches; yellowish brown (10YR 5/6) clay loam; few fine distinct grayish brown (10YR 5/2) mottles; massive; firm; slightly acid.

The thickness of the solum ranges from 42 to more than 60 inches. Some pedons have a stone line in the upper part of the 2B horizon.

The Ap horizon has hue of 10YR and chroma of 2 or 3. It typically is silt loam, but the range includes loam. Some pedons have an E horizon. This horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam or silt loam. The 2Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is clay or clay loam in which the content of clay ranges from 35 to 48 percent.

Menfro Series

The Menfro series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 2 to 30 percent.

Menfro soils are similar to Crider and Minnith soils and commonly are adjacent to Hatton and Weller soils. Crider soils have more clay in the lower part of the B horizon than the Menfro soils. They are on the lower slopes. Hatton soils have more clay and glacial material in the lower part than the Menfro soils. They are in landscape positions similar to those of the Menfro soils. Minnith soils have more sand in the lower part of the subsoil than the Menfro soils. Weller soils have more clay than the Menfro soils and have mottles with chroma of 2 in the upper 10 inches of the argillic horizon. They are on toe slopes and high terraces.

Typical pedon of Menfro silt loam, 5 to 9 percent slopes, eroded, 1,300 feet east and 550 feet south of

the northwest corner of sec. 13, T. 50 N., R. 1 E., UTM coordinates 4,330,265 meters N., 685,525 meters E.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

Bt1—6 to 12 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak very fine subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; few thin silt coatings; strongly acid; clear smooth boundary.

Bt2—12 to 32 inches; brown (7.5YR 4/4) silty clay loam; moderate very fine subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; common thin silt coatings; strongly acid; gradual smooth boundary.

Bt3—32 to 42 inches; brown (7.5YR 4/4) silt loam; weak very fine subangular blocky structure; friable; few fine roots; few faint clay films in pores; common thin silt coatings; strongly acid; gradual smooth boundary.

C—42 to 60 inches; brown (7.5YR 4/4) silt loam; massive; friable; few thin silt coatings; few black stains; medium acid.

The thickness of the solum ranges from 38 to more than 50 inches. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR and chroma of 3 or 4. The content of clay in the upper 20 inches of the argillic horizon is 30 to 35 percent.

Mexico Series

The Mexico series consists of deep, somewhat poorly drained soils on uplands. These soils formed in loess and in the underlying pedisediment. Permeability is very slow. Slopes range from 1 to 5 percent.

Mexico soils are similar to Putnam soils and commonly are adjacent to Brevator, Keswick, and Putnam soils. Brevator and Keswick soils contain more sand than the Mexico soils and have a lighter colored surface layer. Also, they are lower on the landscape. Putnam soils are poorly drained and are on broad upland divides above the Mexico soils. They are characterized by an abrupt textural change between the E and B horizons.

Typical pedon of Mexico silt loam, 1 to 5 percent slopes, 650 feet south and 100 feet east of the northwest corner of sec. 31, T. 49 N., R. 1 W., UTM coordinates 4,315,480 meters N., 667,120 meters E.

Ap—0 to 9 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine granular structure; very friable; common fine roots; neutral; abrupt smooth boundary.

Bt1—9 to 18 inches; dark grayish brown (10YR 4/2) silty clay; many fine prominent yellowish red (5YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; many prominent clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—18 to 22 inches; grayish brown (10YR 5/2) silty clay; few fine faint dark gray (10YR 4/1) and few fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; common prominent clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt3—22 to 43 inches; grayish brown (10YR 5/2) silty clay; many medium prominent yellowish brown (10YR 5/6) mottles; weak very fine subangular blocky structure; firm; few distinct clay films in root pores; strongly acid; clear smooth boundary.

2C—43 to 60 inches; grayish brown (10YR 5/2) silty clay; many medium prominent brownish yellow (10YR 6/8) mottles; massive; firm; few sand grains; medium acid.

The thickness of the solum ranges from 30 to more than 50 inches. The Ap horizon has value and chroma of 2 or 3. It is 6 to 10 inches thick. The Bt horizon has value of 4 or 5. It is silty clay loam or silty clay.

Minnith Series

The Minnith series consists of deep, well drained soils on uplands. These soils formed in loess and in loamy residuum underlain by sandstone. Permeability is moderately slow. Slopes range from 9 to 20 percent.

Minnith soils are similar to Menfro soils and commonly are adjacent to Menfro and Ramsey soils. Menfro soils have less sand in the lower part than the Minnith soils and formed in thicker deposits of loess. Ramsey soils have sandstone bedrock within a depth of 20 inches. They are in the lower landscape positions.

Typical pedon of Minnith silty clay loam, 9 to 14 percent slopes, eroded, 3,500 feet east and 2,000 feet south of the northwest corner of sec. 3, T. 49 N., R. 2 E., UTM coordinates 4,323,590 meters N., 693,120 meters E.

Ap—0 to 6 inches; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; weak very fine subangular blocky structure; friable; few fine roots; neutral; abrupt smooth boundary.

Bt1—6 to 12 inches; strong brown (7.5YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; few very fine roots; few distinct clay films on faces of peds; few thin silt coatings; slightly acid; clear smooth boundary.

Bt2—12 to 28 inches; strong brown (7.5YR 4/6) silty clay loam; weak fine subangular blocky structure; firm; few distinct clay films on faces of peds; few thin silt coatings; few black stains; medium acid; clear smooth boundary.

2Bt3—28 to 36 inches; yellowish brown (10YR 5/6) sandy clay loam; common fine distinct dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; friable; few faint clay films on faces of peds; common thick silt coatings; medium acid; gradual smooth boundary.

2Bt4—36 to 60 inches; yellowish brown (10YR 5/6) sandy clay loam; weak fine subangular blocky structure; friable; few faint clay films on faces of peds; slightly acid.

The thickness of the solum ranges from 48 to more than 60 inches. The depth to sandstone bedrock is more than 60 inches. The thickness of the loess ranges from 20 to 40 inches.

The Ap horizon has chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. The 2Bt horizon has colors similar to those of the Bt horizon. It is sandy clay loam, loam, or clay loam. The content of sand increases with increasing depth.

Moniteau Series

The Moniteau series consists of deep, poorly drained soils on low stream terraces. These soils formed in silty alluvium. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Moniteau soils commonly are adjacent to Haymond and Kennebec soils on flood plains. Haymond soils are well drained. They do not have a B horizon. Kennebec soils are moderately well drained. They have a mollic epipedon.

Typical pedon of Moniteau silt loam, 1,700 feet north and 200 feet west of the southeast corner of sec. 34, T. 50 N., R. 2 E., UTM coordinates 4,324,720 meters N., 693,580 meters E.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate very fine granular structure; very friable; few fine roots; neutral; clear smooth boundary.

E—9 to 15 inches; dark grayish brown (10YR 4/2) silt loam; weak very fine subangular blocky structure; very friable; few fine roots; common thin silt coatings on faces of peds; slightly acid; clear smooth boundary.

Btg1—15 to 27 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine prominent strong brown (7.5YR 4/6) mottles; weak very fine subangular blocky structure; firm; few fine roots; common thin silt coatings and distinct clay films on faces of peds; few black concretions; medium acid; clear smooth boundary.

Btg2—27 to 38 inches; grayish brown (10YR 5/2) silty clay loam; common fine prominent strong brown (7.5YR 4/6) mottles; weak very fine subangular blocky structure; firm; common distinct clay films on worm casts; few pockets of silt; medium acid; clear smooth boundary.

Btg3—38 to 60 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silty clay loam; common fine prominent strong brown (7.5YR 4/6) mottles; weak very fine subangular blocky structure; firm; few faint clay films on faces of peds; common black stains; medium acid.

The thickness of the solum ranges from 40 to more than 60 inches. The A horizon has chroma of 1 or 2. The E horizon has value of 4 or 5. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2.

Portage Series

The Portage series consists of deep, very poorly drained soils on the flood plains along the Mississippi River. These soils formed in acid, clayey alluvium. Permeability is very slow. Slopes are 0 to 1 percent.

Portage soils commonly are adjacent to Carlow and Dockery soils. The adjacent soils have less clay than the Portage soils. Carlow soils are in landscape positions similar to those of the Portage soils. Dockery soils are in the higher positions near channels and on islands.

Typical pedon of Portage clay, 200 feet south and 4,000 feet east of the northwest corner of sec. 19, T. 49 N., R. 3 E., UTM coordinates 4,319,820 meters N., 698,210 meters E.

Ap—0 to 4 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; firm; few fine roots; neutral; abrupt smooth boundary.

A—4 to 20 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; firm; few fine roots; strongly acid; clear smooth boundary.

Bg1—20 to 40 inches; dark gray (10YR 4/1) clay; common fine distinct yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; firm; few fine roots; strongly acid; gradual smooth boundary.

Bg2—40 to 60 inches; dark gray (10YR 4/1) clay; few fine distinct yellowish brown (10YR 5/4) mottles; moderate very fine subangular blocky structure; firm; strongly acid.

The solum is more than 60 inches thick. The A horizon has value of 2 or 3 and chroma of 1 or 2. It typically is clay, but the range includes silty clay. The Bg horizon has hue of 2.5Y or 5Y or is neutral in hue. It has value of 4 or 5 and chroma of 0 to 2. The content of clay in the control section ranges from 60 to 80 percent.

Putnam Series

The Putnam series consists of deep, poorly drained soils on broad upland divides. These soils formed in loess. Permeability is very slow. Slopes are 0 to 1 percent.

Putnam soils are similar to Mexico soils and commonly are adjacent to those soils. Mexico soils are not characterized by an abrupt textural change between the E and B horizons. They are on side slopes.

Typical pedon of Putnam silt loam, 1,500 feet south and 100 feet east of the northwest corner of sec. 22, T. 50 N., R. 3 W., UTM coordinates 4,328,300 meters N., 652,020 meters E.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate very fine granular structure; very friable; common fine roots; neutral; abrupt smooth boundary.

E—9 to 14 inches; grayish brown (10YR 5/2) silt loam; few fine distinct yellowish brown (10YR 5/4) mottles; weak very fine subangular blocky structure; very friable; common thick light gray (10YR 6/1) silt coatings on faces of peds; few fine roots; neutral; abrupt wavy boundary.

Btg1—14 to 18 inches; dark grayish brown (10YR 4/2) silty clay; common medium prominent strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; very firm; common prominent clay films on faces of peds; few fine roots; strongly acid; gradual smooth boundary.

Btg2—18 to 24 inches; dark grayish brown (10YR 4/2) silty clay; few fine prominent strong brown (7.5YR 4/6) mottles; moderate fine subangular blocky structure; very firm; common prominent clay films on faces of peds; strongly acid; gradual smooth boundary.

Btg3—24 to 40 inches; dark grayish brown (10YR 4/2) silty clay; few fine prominent yellowish red (5YR 4/6) mottles; moderate fine subangular blocky structure; very firm; common distinct very dark grayish brown (10YR 3/2) clay films in pores; strongly acid; clear smooth boundary.

Btg4—40 to 50 inches; grayish brown (10YR 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/8) mottles; weak very fine subangular blocky structure; firm; few faint clay films in pores; strongly acid; abrupt smooth boundary.

Cg—50 to 60 inches; gray (10YR 5/1) silty clay loam; few medium prominent strong brown (7.5YR 5/8) mottles; massive; firm; strongly acid.

The thickness of the solum ranges from 36 to about 60 inches. The thickness of the A horizon combined with that of the E horizon ranges from 12 to 20 inches. The E horizon has value of 5 or 6 and chroma of 1 or 2. It has mottles with value of 3 to 5 and chroma of 1 to 4. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 or 2. It has mottles with hue of 2.5YR to 10YR, value of 4 or 5, and chroma of 4 to 8. The reddest mottles are mainly in the upper 4 to 10 inches of this horizon. The C horizon has hue of 10YR or 2.5YR, value of 5 or 6, and chroma of 1 or 2. It has mottles with the same range in color as those in the B horizon.

Ramsey Series

The Ramsey series consists of shallow, somewhat excessively drained, rapidly permeable soils on uplands. These soils formed in sandstone residuum. Slopes range from 9 to 65 percent.

Ramsey soils commonly are adjacent to Minnith soils. The adjacent soils have more clay than the Ramsey soils and are more than 60 inches deep over bedrock. They generally are in the higher landscape positions.

Typical pedon of Ramsey loam, in an area of Ramsey-Minnith-Rock outcrop complex, 9 to 65 percent slopes, 2,450 feet north and 300 feet east of the southwest corner of sec. 3, T. 49 N., R. 2 E., UTM coordinates 692,120 meters E., 4,323,060 meters N.

A—0 to 6 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; strongly acid; clear smooth boundary.

Bw—6 to 12 inches; dark yellowish brown (10YR 4/4) loam; weak very fine subangular blocky structure; very friable; few fine roots; about 5 percent sandstone fragments; strongly acid; clear smooth boundary.

R—12 inches; sandstone bedrock.

The thickness of the solum and the depth to sandstone bedrock range from 10 to 20 inches. The content of coarse fragments ranges from 0 to 15 percent in the solum.

The A horizon has value of 3 or 4. It typically is loam, but the range includes sandy loam. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is loam, sandy loam, or fine sandy loam.

Twomile Series

The Twomile series consists of deep, poorly drained, slowly permeable soils on stream terraces. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Twomile soils commonly are adjacent to Haymond and Moniteau soils. Haymond soils are not so gray as the Twomile soils and do not have a B horizon. They are on flood plains. Moniteau soils are not characterized by an abrupt textural change between the E and B horizons. They are in landscape positions similar to those of the Twomile soils.

Typical pedon of Twomile silt loam, 800 feet west and 2,100 feet south of the northeast corner of sec. 24, T. 49 N., R. 1 W., UTM coordinates 676,840 meters E., 4,318,155 meters N.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; friable; many very fine roots; medium acid; abrupt smooth boundary.

A—7 to 18 inches; brown (10YR 4/3) silt loam; weak thin platy structure; friable; common fine roots; strongly acid; clear smooth boundary.

Ex—18 to 29 inches; grayish brown (10YR 5/2) silt; few fine faint dark brown (10YR 4/3) mottles; weak medium platy structure; firm; compact and brittle when moist; few fine roots; many thick light gray (10YR 7/2) silt coatings; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt1—29 to 34 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate very fine subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; common moderately thick silt coatings; common fine round concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt2—34 to 58 inches; grayish brown (10YR 5/2) silty clay loam; moderate very fine subangular blocky structure; firm; few fine roots; common faint dark grayish brown (10YR 4/2) clay films on faces of peds; common thin silt coatings; few fine rounded concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Bt3—58 to 60 inches; grayish brown (10YR 5/2) silty clay loam; weak very fine subangular blocky structure; firm; few faint clay films on faces of peds; few thin silt coatings; medium acid.

The thickness of the solum is more than 60 inches. The thickness of the A horizon combined with that of the E horizon ranges from 26 to 36 inches. The Ex horizon has value of 5 or 6 and chroma of 2 or 3 and has mottles with higher chroma. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2 and has mottles with higher chroma.

Weller Series

The Weller series consists of deep, moderately well drained, slowly permeable soils on uplands and high stream terraces. These soils formed in loess. Slopes range from 2 to 7 percent.

Weller soils are similar to Hatton soils and commonly are adjacent to Haymond and Menfro soils. Hatton soils do not have mottles with chroma of 2 in the upper part of the B horizon. Haymond soils are not so gray as the Weller soils and do not have a B horizon. They are on flood plains. Menfro soils do not have mottles with chroma of 2 in the argillic horizon and contain less clay than the Weller soils. Also, they are at higher elevations.

Typical pedon of Weller silt loam, 2 to 7 percent slopes, 500 feet west and 2,375 feet north of the southeast corner of sec. 27, T. 49 N., R. 2 E., UTM coordinates 693,480 meters E., 4,316,590 meters N.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; few fine roots; slightly acid; abrupt smooth boundary.

E—9 to 12 inches; brown (10YR 5/3) silt loam; weak fine subangular blocky structure; friable; many pale brown (10YR 6/3) silt coatings on faces of peds; common very fine black concretions of iron and manganese oxide; few fine roots; medium acid; abrupt smooth boundary.

Bt1—12 to 21 inches; yellowish brown (10YR 5/4) silty clay; few fine faint grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; firm; common distinct clay films on faces of peds; few thin silt coatings; few very fine black concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt2—21 to 30 inches; yellowish brown (10YR 5/4) silty clay; few fine faint grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; very firm; common prominent clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt3—30 to 44 inches; yellowish brown (10YR 5/4) silty clay; few fine faint grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; very firm; common prominent clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt4—44 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; common medium faint yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; weak fine subangular blocky structure; firm; few faint clay films on faces of peds; strongly acid.

The thickness of the solum is 60 inches or more. The Ap horizon has value of 4 or 5 and chroma of 2 or 3. Pedons in uncultivated areas have an A horizon that has value of 3 or 4 and chroma of 1 or 2. The Bt horizon has hue of 10YR or 7.5YR and value of 4 or 5.

Factors of Soil Formation

Soil forms through processes that act on accumulated or deposited geologic material. The characteristics of the soil are determined by the type of parent material; the plant and animal life on and in the soil; the climate under which the soil-forming factors were active; relief, or lay of the land; and the length of time that the forces of soil formation have been active. Human activities also affect soil formation.

Parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The climate determines the amount of water available for leaching and the amount of heat available for physical and chemical changes. Relief commonly modifies the effects of the other factors. Finally, time is needed for the transformation of the parent material into a soil. Generally, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated that few generalizations can be made about the effect of any one factor unless conditions are specified for the others.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. The accumulation or deposition of this material is the first step in the development of a soil profile. The characteristics of the parent material determine the limits of the chemical and mineralogical composition of the soil. The soils in Lincoln County formed dominantly in material weathered from bedrock; glacial till, or ice-deposited material; loess, or wind-deposited material; and alluvium, or water-deposited material. Of less importance is colluvium, which is material transported short distances downslope by the action of water and gravity.

The residuum in Lincoln County is material weathered from limestone, sandstone, and shale. Goss soils formed in material weathered from cherty limestone and thinly interbedded shale. Brussels, Bucklick, and Gasconade formed in material weathered from nearly chert-free limestone and interbedded shale. Ramsey soils formed in sandstone residuum.

Glacial material made up of clay, silt, sand, gravel, stones, and a few boulders was transported by the action of ice. Some of the material in the mass of glacial till was moved long distances, but much of it is of fairly local origin. Brevator and Keswick soils formed in glacial till.

Loess, or silty material transported by the wind, is the most extensive parent material in the county. It was transported after the retreat of the last glacier. The wind carried this material mainly from the flood plains along the Mississippi and Cuivre Rivers. The deepest deposits are on hills bordering the flood plains. Menfro and Weller soils formed in these deposits. In areas farther away from the source, the deposits are thinner and contain more clay. In the prairie region, where the loess was deposited on wide, nearly level or gently sloping divides, slow runoff resulted in the formation of somewhat poorly drained and poorly drained soils, such as Mexico and Putnam soils. On narrow ridgetops, where the deposits are thin, Hatton soils formed in loess and in the underlying glacial material.

All of the soils on the flood plains in Lincoln County formed in alluvium. Because of its diverse origins and the varying speeds of water from which it was deposited, this alluvium varies greatly in texture and in chemical and mineralogical composition. Local uplands are the only source of the alluvium on flood plains along small tributary streams. The vast drainage system of the Mississippi River is a source of the alluvium along the river's banks. Carlow, Dockery, and Portage soils formed in alluvial material on the flood plains along the Mississippi River. This material washed mainly from acid glacial deposits and is relatively infertile.

Local streams and drainageways that flow from the uplands have carried and deposited material on the smaller flood plains. Kennebec, Haymond, and Moniteau are typical examples of the soils that formed in these deposits. They are high in content of silt derived from the surrounding loess-capped uplands. Dupo soils formed in alluvial deposits from two sources. The silty upper part formed in recent deposits washed from the adjoining loess-covered uplands, and the lower part formed in clayey deposits on the flood plains along the Mississippi River.

Plant and Animal Life

Organic matter is an important soil component. Plants, animals, insects, bacteria, and fungi are important in the formation of soils, and their decomposed residue makes up the organic fraction of the soil. Leaves and other plant remains decay and add nutrients and organic matter. Chemicals are removed by plant roots and are translocated to the parts of the plants above the soil. The roots loosen soil aggregates. When they decay, they leave channels through which water and air can move.

The kind of native vegetation has significantly affected soil formation in Lincoln County. Prairie grasses and deciduous trees differ markedly in their rooting patterns, lifespan, and mineral composition. There are significant differences in the micro-organisms and animals associated with each.

The organic matter added to the soils that formed under forest vegetation is mostly in the form of leaves, twigs, and logs, which decompose at the surface and tend to be acid. These soils have a very thin, dark surface layer and a leached subsurface layer.

In contrast, the organic matter added to the soils that formed under prairie grasses is largely the residue from the yearly death and decay of annual and biennial plants. The tops of the plants decompose at the surface, but much of the organic material in the soil is in the form of roots. The material thus added tends to be richer in mineral composition than forest residue. As a result, the soils that formed under prairie grasses have a dark surface layer that is much thicker than that of forest soils and tend to be less acid.

Worms, insects, burrowing animals, and large animals affect the soils in various ways. The effects of bacteria and fungi, however, are more significant than those of animals. Bacteria and fungi facilitate the decomposition of organic material, improve tilth, and fix nitrogen in the soils. The population of soil organisms is directly related to the rate at which organic material decomposes in the soils. The kinds of organisms in a given area and their activity are determined by the kind of vegetation in that area.

In Lincoln County human activities have profoundly affected soil formation in a remarkedly short time. The major alterations result from changes in vegetation, drainage, relief, and accelerated erosion. The original prairie grasses have been replaced by row crops. Nearly all of the flood plains and many upland areas are cleared and farmed. Chemicals are used to fertilize desirable plants and to control unwanted plants and insects. Wet soils are drained, sloping soils are terraced, and lime is applied to acid soils. A new cycle of soil formation begins where huge earth-moving equipment completely alters and rearranges soil profiles in the process of urban and suburban development.

Many of the human activities have resulted in increased production of food and fiber. In terms of sustained productivity, however, the net effect of these activities is adverse. Accelerated erosion on uplands continues to reduce the productive capacity of many soils. Good management can reverse this trend.

Climate

Climate has been an important factor in the formation of the soils in Lincoln County. Rainfall and temperature continue to affect soil formation. Climate affects the rate of geologic erosion, which in turn affects the shape and character of the landforms in a given area. Changes in the relative abundance and species of plants and animals are strongly influenced by climatic changes. Present climatic conditions favor the growth of trees at the expense of prairie grasses. The prairie region in Lincoln County may be a relic of a more arid climatic cycle. The reason for its persistence until the time of settlement is not understood.

Changes in climate caused the glacial periods. Thousands of years of cool temperatures resulted in the massive glaciers that moved into the area many years ago. Warmer temperatures subsequently resulted in severe geologic erosion and the blowing of the loess that covered most of Lincoln County at one time. Extreme changes in climate occurred very slowly; therefore, there were long intermediate periods when different types of vegetation grew. Soils formed on the surface and were later covered by loess, truncated, and mixed by erosion or completely washed away. Keswick and Brevator are examples of soils that formed mainly in these old truncated or weathered materials.

Climate has greatly influenced the nature and degree of weathering in the soils of Lincoln County. Temperature and rainfall have facilitated rapid chemical changes and physical disintegration in the soils. Calcium carbonate and other soluble salts have been removed through leaching. As a result, soil fertility has declined. Climatic factors also have resulted in the rapid breakdown of the minerals that form clay in the soil. The clay has been moved downward into the subsoil. This process is known as eluviation. Nearly all soils in the uplands show these effects.

Relief

Relief is characterized by the gradient, length, shape, aspect, and uniformity of the slopes that make up a landscape. It helps to determine the pattern and distribution of soils on a landscape because of its influence on drainage, runoff, and erosion.

Relief varies greatly in Lincoln County. Slopes range from nearly level to very steep. Runoff is slower on Putnam, Twomile, and other nearly level soils than on the more sloping soils. As a result, more water generally enters the nearly level soils. This water accelerates leaching, the translocation of clay, and other soil-forming

processes. Over long periods, a subsoil high in content of clay forms under a leached subsurface layer.

Runoff is so excessive on the steepest soils in the county that the rate of soil formation is slowed. Removal of the products of weathering through geologic erosion almost keeps pace with their accumulation. Gasconade and Ramsey soils formed under these conditions.

Time

The soils in Lincoln County are very young to old. The very young soils formed in alluvium deposited by floodwater from the Cuivre River. In some areas they are only a few years old. Kennebec and Haymond soils are examples.

The oldest soils are those that formed in loess and glacial till in nearly level and gently sloping areas at the highest elevations in the county. Putnam and Mexico soils are examples. These soils are characterized by the maximum development of distinct horizons. The carbonates that were originally in the parent material have been leached to a great depth, and the soils are quite acid throughout. Clay has accumulated in distinct subsoil layers, both through weathering and through translocation by water. A leached subsurface layer formed where a perched water table is above a relatively impervious subsoil.

Most of the soils in Lincoln County are intermediate in age. The Moniteau soils on stream terraces are an example. They have a clay-enriched subsoil. They formed in the same kind of alluvium as the young Haymond soils on the adjacent flood plains.

The strongly sloping to very steep, shallow Gasconade soils formed in material weathered from limestone. This parent material is far older than the oldest soil in the county. These soils are considered young, however, because the removal of soil material through geologic erosion almost keeps pace with the accumulation of soil material through weathering.

The age of a soil, as expressed in profile characteristics, is not necessarily a reflection of time in years. Rather, it is a result of the interaction among various soil-forming factors over a period of time. Age is influenced by topography and climate. It is determined by the degree of profile development in a given soil.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow

represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can

be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces

on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Elsberry, Missouri)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	36.7	16.1	26.4	68	-14	8	1.49	0.60	2.24	4	5.7
February---	41.9	20.9	31.4	73	-7	13	1.85	.90	2.68	4	4.3
March------	52.4	30.4	41.4	86	5	49	3.14	1.52	4.53	7	3.4
April------	66.6	43.1	54.9	89	22	190	3.78	2.30	5.10	8	.3
May--------	76.1	51.7	63.9	93	32	438	4.00	2.10	5.66	8	.0
June-------	85.3	61.2	73.3	98	43	699	3.75	1.58	5.59	6	.0
July-------	89.3	65.2	77.3	102	48	846	4.07	1.73	6.05	6	.0
August-----	87.5	63.2	75.4	102	48	787	3.61	1.33	5.51	5	.0
September--	80.7	54.9	67.8	98	36	534	3.44	1.32	5.20	6	.0
October----	69.4	42.9	56.2	91	22	236	2.95	1.07	4.51	5	.0
November---	54.2	32.0	43.1	81	9	28	2.19	1.07	3.16	5	1.3
December---	41.6	22.3	32.0	70	-6	0	2.22	.90	3.32	5	3.4
Yearly:											
Average--	65.1	42.0	53.6	---	---	---	---	---	---	---	---
Extreme--	---	---	---	103	-17	---	---	---	---	---	---
Total----	---	---	---	---	---	3,828	36.49	30.56	42.71	69	18.4

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Elsberry, Missouri)

Probability	Temperature: 24° F or lower	Temperature: 28° F or lower	Temperature: 32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 14	Apr. 21	May 5
2 years in 10 later than--	Apr. 10	Apr. 18	Apr. 30
5 years in 10 later than--	Apr. 2	Apr. 11	Apr. 21
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 22	Oct. 13	Oct. 2
2 years in 10 earlier than--	Oct. 27	Oct. 18	Oct. 8
5 years in 10 earlier than--	Nov. 5	Oct. 27	Oct. 18

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Elsberry, Missouri)

Probability	Daily minimum temperature during growing season: Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	197	182	160
8 years in 10	203	188	167
5 years in 10	216	199	179
2 years in 10	229	210	192
1 year in 10	235	215	199

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
2D	Goss silt loam, 9 to 14 percent slopes	1,760	0.4
2F	Goss cherty silt loam, 14 to 50 percent slopes	9,100	2.3
3	Twomile silt loam	4,185	1.0
5C2	Bucklick silty clay loam, 5 to 9 percent slopes, eroded	2,895	0.7
5D2	Bucklick silty clay loam, 9 to 14 percent slopes, eroded	12,905	3.2
5E2	Bucklick silty clay loam, 14 to 20 percent slopes, eroded	2,790	0.7
6C2	Crider silt loam, 5 to 9 percent slopes, eroded	7,870	2.0
6D2	Crider silt loam, 9 to 14 percent slopes, eroded	9,575	2.4
6E	Crider silt loam, 14 to 20 percent slopes	3,125	0.8
7B	Menfro silt loam, 2 to 5 percent slopes	6,530	1.6
7C2	Menfro silt loam, 5 to 9 percent slopes, eroded	16,560	4.1
7D2	Menfro silt loam, 9 to 14 percent slopes, eroded	8,810	2.2
7E2	Menfro silt loam, 14 to 20 percent slopes, eroded	2,305	0.6
7F	Menfro silt loam, 20 to 30 percent slopes	2,335	0.6
10F	Gasconade-Rock outcrop complex, 9 to 70 percent slopes	3,585	0.9
12	Kennebec silt loam	3,345	0.8
16D2	Minnith silty clay loam, 9 to 14 percent slopes, eroded	1,230	0.3
17F	Ramsey-Minnith-Rock outcrop complex, 9 to 65 percent slopes	730	0.2
22F	Goss-Gasconade-Brussels complex, 9 to 70 percent slopes	38,235	9.5
24C2	Keswick silt loam, 5 to 9 percent slopes, eroded	51,115	12.7
24D2	Keswick silt loam, 9 to 14 percent slopes, eroded	27,880	7.0
31B	Hatton silt loam, 2 to 5 percent slopes	23,255	5.8
31C	Hatton silt loam, 5 to 9 percent slopes	20,230	5.0
33	Haymond silt loam	22,095	5.5
34F	Brevator loam, 14 to 30 percent slopes	12,295	3.1
35B	Mexico silt loam, 1 to 5 percent slopes	48,180	12.0
36	Putnam silt loam	1,440	0.4
40	Moniteau silt loam	9,960	2.5
43	Cedargap silt loam	880	0.2
44	Dameron silt loam	4,130	1.0
48C	Weller silt loam, 2 to 7 percent slopes	6,680	1.7
61E	Crider silt loam, karst, 9 to 20 percent slopes	550	0.1
71D	Menfro silt loam, karst, 5 to 14 percent slopes	560	0.1
79	Dupo silt loam	1,430	0.4
80	Portage clay	12,165	3.0
82	Dockery silty clay loam	4,943	1.2
85	Carlow silty clay loam	11,620	2.9
86	Kampville silt loam	4,080	1.0
91	Pits, quarries	235	0.1
	Total land area	401,593	100.0
	Water areas more than 40 acres in size	8,365	
	Total area	409,958	

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
3	Twomile silt loam (where drained)
7B	Menfro silt loam, 2 to 5 percent slopes
12	Kennebec silt loam
31B	Hatton silt loam, 2 to 5 percent slopes
33	Haymond silt loam
35B	Mexico silt loam, 1 to 5 percent slopes (where drained)
36	Putnam silt loam (where drained)
40	Moniteau silt loam (where drained)
43	Cedargap silt loam (where protected from flooding or not frequently flooded during the growing season)
44	Dameron silt loam
48C	Weller silt loam, 2 to 7 percent slopes
79	Dupo silt loam
80	Portage clay (where drained)
82	Dockery silty clay loam (where protected from flooding or not frequently flooded during the growing season)
85	Carlow silty clay loam (where drained)
86	Kampville silt loam (where drained)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchardgrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
2D-------------- Goss	VIs	---	---	---	---	1.2	4.0
2F-------------- Goss	VIIs	---	---	---	---	---	---
3--------------- Twomile	IIIw	70	25	60	28	3.0	6.0
5C2------------- Bucklick	IIIe	55	21	50	22	2.4	5.6
5D2------------- Bucklick	IVe	50	18	45	20	2.3	5.2
5E2------------- Bucklick	VIe	---	---	---	---	2.0	4.8
6C2------------- Crider	IIIe	84	30	74	45	3.5	7.0
6D2------------- Crider	IIIe	75	25	70	40	3.2	6.2
6E-------------- Crider	IVe	58	22	---	---	3.0	5.8
7B-------------- Menfro	IIe	92	35	90	50	4.0	8.2
7C2------------- Menfro	IIIe	84	29	74	45	3.5	7.2
7D2------------- Menfro	IIIe	75	26	70	40	3.2	6.6
7E2------------- Menfro	IVe	60	25	60	30	3.0	6.0
7F-------------- Menfro	VIe	---	---	---	---	2.5	5.4
10F**----------- Gasconade-Rock outcrop	VIIs	---	---	---	---	---	---
12-------------- Kennebec	IIw	120	50	110	55	5.5	---
16D2------------ Minnith	IIIe	70	22	60	30	3.3	6.0
17F**----------- Ramsey-Minnith-Rock outcrop	VIIe	---	---	---	---	---	---
22F------------- Goss-Gasconade-Brussels	VIIs	---	---	---	---	---	---

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Grain sorghum	Winter wheat	Orchardgrass-alfalfa hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
24C2------------ Keswick	IIIe	71	24	65	40	3.0	6.0
24D2------------ Keswick	IVe	50	21	45	30	2.6	5.0
31B------------- Hatton	IIe	82	35	80	50	3.7	7.4
31C------------- Hatton	IIIe	74	30	65	45	3.4	6.8
33-------------- Haymond	IIw	110	45	---	55	5.5	8.0
34F------------- Brevator	VIe	---	---	---	---	2.2	4.0
35B------------- Mexico	IIe	90	40	85	50	3.5	7.0
36-------------- Putnam	IIw	80	35	80	40	3.2	6.5
40-------------- Moniteau	IIIw	84	35	80	40	3.7	7.4
43-------------- Cedargap	IIIw	60	20	65	30	3.0	6.0
44-------------- Dameron	IIw	70	25	70	40	3.5	7.0
48C------------- Weller	IIIe	80	34	75	40	4.2	8.5
61E------------- Crider	IVe	60	20	60	30	4.0	8.0
71D------------- Menfro	IIIe	70	25	63	35	3.4	6.8
79-------------- Dupo	IIw	112	43	90	46	5.2	8.0
80-------------- Portage	IIIw	60	35	---	30	---	2.5
82-------------- Dockery	IVw	---	22	37	---	---	---
85-------------- Carlow	IIIw	72	35	72	35	---	6.8
86-------------- Kampville	IIw	105	40	90	45	5.0	8.0
91**. Pits							

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
2D------------- Goss	3A	Slight	Slight	Slight	Slight	White oak-----------	60	43	Sweetgum, yellow-poplar, green ash.
						Shortleaf pine------	---	---	
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
						Black oak-----------	---	---	
2F------------- Goss	3R	Slight	Moderate	Moderate	Slight	White oak-----------	60	43	Sweetgum, yellow-poplar, green ash.
						Shortleaf pine------	---	---	
						Post oak------------	---	---	
						Blackjack oak-------	---	---	
						Black oak-----------	---	---	
3-------------- Twomile	4W	Slight	Severe	Moderate	Moderate	Pin oak-------------	80	62	Pin oak, eastern cottonwood, pecan, silver maple, green ash, sweetgum.
5C2, 5D2-------- Bucklick	3A	Slight	Slight	Slight	Slight	White oak-----------	61	44	Yellow-poplar, green ash, white oak, eastern white pine.
						Northern red oak----	---	---	
						Black oak-----------	---	---	
						Sugar maple---------	---	---	
						Post oak------------	---	---	
5E2------------- Bucklick	3R	Moderate	Moderate	Slight	Slight	White oak-----------	61	44	Yellow-poplar, green ash, white oak, eastern white pine.
						Northern red oak----	---	---	
						Black oak-----------	---	---	
						Sugar maple---------	---	---	
						Post oak------------	---	---	
6C2, 6D2-------- Crider	3A	Slight	Slight	Slight	Slight	White oak-----------	65	48	Black walnut, eastern white pine, yellow-poplar, white ash.
						Northern red oak----	70	52	
						Shortleaf pine------	---	---	
						Black oak-----------	---	---	
6E-------------- Crider	3R	Moderate	Moderate	Slight	Slight	White oak-----------	65	48	Black walnut, eastern white pine, yellow-poplar, white ash.
						Northern red oak----	70	52	
						Shortleaf pine------	---	---	
						Black oak-----------	---	---	
7B, 7C2, 7D2---- Menfro	3A	Slight	Slight	Slight	Slight	White oak-----------	65	48	Black walnut, green ash, yellow-poplar, white oak, eastern white pine, sugar maple.
						Northern red oak----	75	57	
						Black oak-----------	73	55	
						White ash-----------	70	66	
						Sugar maple---------	68	43	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
7E2, 7F Menfro	3R	Moderate	Moderate	Slight	Slight	White oak	65	48	Black walnut, green ash, yellow-poplar, white oak, eastern white pine, sugar maple.
						Northern red oak	75	57	
						Black oak	73	55	
						White ash	70	66	
						Sugar maple	68	43	
10F**:									
Gasconade	2R	Moderate	Severe	Severe	Severe	Chinkapin oak	40	26	Eastern redcedar.
						Eastern redcedar	30	---	
						White ash	---	---	
						Sugar maple	---	---	
						Mockernut hickory	---	---	
						Post oak	---	---	
						Blackjack oak	---	---	
Rock outcrop.									
12 Kennebec	9A	Slight	Slight	Slight	Slight	Eastern cottonwood	100	128	Black walnut, bur oak, hackberry, green ash, eastern cottonwood, American sycamore.
						Bur oak	63	46	
						Black walnut	79	---	
						Hackberry	---	---	
						Green ash	---	---	
16D2 Minnith	3A	Slight	Slight	Slight	Slight	Northern red oak	70	52	Black walnut, white ash, yellow-poplar, white oak, northern red oak, black oak.
						White oak	60	43	
17F**:									
Ramsey	2R	Severe	Severe	Severe	Severe	Chinkapin oak	40	26	Eastern redcedar.
						Eastern redcedar	30	---	
Minnith	3R	Moderate	Moderate	Slight	Slight	White oak	60	43	Black walnut, white ash, yellow-poplar, northern red oak, black oak.
						Northern red oak	70	52	
Rock outcrop.									
22F**:									
Goss	3R	Moderate	Severe	Severe	Slight	White oak	60	43	Sweetgum, yellow-poplar, green ash.
						Shortleaf pine	---	---	
						Post oak	---	---	
						Blackjack oak	---	---	
						Black oak	---	---	

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
22F**:									
Gasconade	2R	Moderate	Severe	Severe	Severe	Chinkapin oak	40	26	Eastern redcedar.
						Eastern redcedar	30	---	
						White ash	---	---	
						Sugar maple	---	---	
						Mockernut hickory	---	---	
						Post oak	---	---	
						Blackjack oak	---	---	
Brussels	3R	Moderate	Severe	Severe	Slight	White oak	60	43	Northern red oak, white oak.
						Northern red oak	65	48	
						Black oak	---	---	
						Shagbark hickory	---	---	
						Black walnut	---	---	
24C2, 24D2 Keswick	3C	Slight	Slight	Moderate	Moderate	White oak	55	38	Eastern white pine, red pine, sugar maple.
						Northern red oak	55	38	
31B, 31C Hatton	3C	Slight	Slight	Moderate	Moderate	White oak	56	39	White oak, black oak, bur oak, Norway maple, scarlet oak, white ash.
33 Haymond	9A	Slight	Slight	Slight	Slight	Eastern cottonwood	100	128	Eastern white pine, black walnut, yellow-poplar, black locust.
						White oak	90	72	
						Black walnut	70	---	
34F Brevator	3R	Moderate	Moderate	Slight	Slight	White oak	55	38	Northern red oak.
						Northern red oak	60	43	
						Black oak	---	---	
40 Moniteau	4W	Slight	Severe	Moderate	Moderate	Pin oak	70	52	White oak, pin oak, green ash, eastern cottonwood, silver maple.
43 Cedargap	3A	Slight	Slight	Slight	Slight	Black oak	66	48	Black oak.
44 Dameron	5A	Slight	Slight	Slight	Slight	Green ash	70	75	Black walnut.
						Black walnut	72	---	
						American sycamore	---	---	
						White oak	---	---	
48C Weller	3C	Slight	Slight	Severe	Severe	White oak	55	38	Eastern white pine, red pine, black walnut, sugar maple.

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
61E: Crider	3R	Moderate	Moderate	Slight	Slight	White oak	---	---	Black walnut, eastern white pine, yellow-poplar, loblolly pine, white ash, northern red oak, white oak.
						Sugar maple	---	---	
						Black oak	87	69	
						White ash	---	---	
						Northern red oak	70	52	
						Black walnut	---	---	
						Hickory	---	---	
						Eastern redcedar	---	---	
						Black cherry	---	---	
71D: Menfro	3A	Slight	Slight	Slight	Slight	White oak	65	48	Black walnut, green ash, yellow-poplar, white oak, eastern white pine, sugar maple.
						Northern red oak	75	57	
						Black oak	73	55	
						White ash	70	66	
						Sugar maple	68	43	
80: Portage	6W	Slight	Severe	Severe	Severe	Eastern cottonwood	85	91	Eastern cottonwood, pin oak, pecan, green ash, silver maple, baldcypress.
						Silver maple	80	---	
						Pin oak	75	54	
82: Dockery	4A	Slight	Slight	Slight	Slight	Pin oak	76	58	Pin oak, pecan, eastern cottonwood.
85: Carlow	6W	Slight	Severe	Severe	Moderate	Eastern cottonwood	85	91	Eastern cottonwood, pin oak, pecan, green ash, baldcypress, silver maple.
						Pin oak	75	57	
86: Kampville	9A	Slight	Slight	Slight	Slight	Eastern cottonwood	100	128	Eastern cottonwood, pin oak, green ash.
						Silver maple	95	46	
						Pin oak	75	57	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
2D, 2F Goss	Siberian peashrub	Lilac, Amur honeysuckle, autumn-olive, Tatarian honeysuckle, eastern redcedar, Washington hawthorn, radiant crabapple.	Eastern white pine, jack pine, red pine, Austrian pine.	---	---
3 Twomile	---	Silky dogwood, Amur honeysuckle, American cranberrybush, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Norway spruce, Austrian pine.	Eastern white pine	Pin oak.
5C2, 5D2, 5E2 Bucklick	---	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Eastern white pine, pin oak.
6C2, 6D2, 6E Crider	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, blue spruce, northern white-cedar, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
7B, 7C2, 7D2, 7E2, 7F Menfro	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Washington hawthorn, blue spruce, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
10F*:					
Gasconade.					
Rock outcrop.					
12 Kennebec	---	Amur maple, Amur honeysuckle, lilac, autumn-olive.	Eastern redcedar	Austrian pine, hackberry, pin oak, green ash, honeylocust.	Eastern white pine, eastern cottonwood.
16D2 Minnith	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
17F*:					
Ramsey.					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
17F*: Minnith	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
Rock outcrop.					
22F*: Goss	Siberian peashrub	Lilac, Amur honeysuckle, autumn-olive, Tatarian honeysuckle, eastern redcedar, Washington hawthorn, radiant crabapple.	Eastern white pine, jack pine, red pine, Austrian pine.	---	---
Gasconade.					
Brussels	Siberian peashrub	Amur honeysuckle, autumn-olive, lilac, radiant crabapple, Tatarian honeysuckle, Washington hawthorn, eastern redcedar.	Austrian pine, eastern white pine, jack pine, red pine.	---	---
24C2, 24D2: Keswick	---	Eastern redcedar, Tatarian honeysuckle, Washington hawthorn, arrowwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
31B, 31C: Hatton	---	Amur honeysuckle, American cranberrybush, eastern redcedar, Amur privet, arrowwood, Tatarian honeysuckle, Washington hawthorn.	Austrian pine, osageorange, green ash.	Eastern white pine, pin oak.	---
33: Haymond	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
34F: Brevator	---	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Washington hawthorn, blue spruce, northern white-cedar, white fir.	Austrian pine, eastern white pine, Norway spruce.	Pin oak.
35B: Mexico	---	Amur honeysuckle, American cranberrybush, Tatarian honeysuckle, arrowwood, eastern redcedar, Amur privet, Washington hawthorn.	Green ash, osageorange, Austrian pine.	Eastern white pine, pin oak.	---
36: Putnam	---	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
40: Moniteau	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern white-cedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
43: Cedargap	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, northern white-cedar, white fir, Washington hawthorn, blue spruce.	Norway spruce	Eastern white pine, pin oak.
44: Dameron	---	American cranberrybush, silky dogwood, Amur honeysuckle, Amur privet.	Blue spruce, Norway spruce, Washington hawthorn, Austrian pine, northern white-cedar, white fir.	---	Eastern white pine, pin oak.
48C: Weller	---	American cranberrybush, Tatarian honeysuckle, Amur honeysuckle, arrowwood, Washington hawthorn, Amur privet, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
61E: Crider	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, blue spruce, northern white-cedar, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
71D: Menfro	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Washington hawthorn, blue spruce, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
79: Dupo	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
80: Portage	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Austrian pine, Washington hawthorn, northern white-cedar, blue spruce, Norway spruce, white fir.	Eastern white pine	Pin oak.
82: Dockery	---	Silky dogwood, Amur honeysuckle, American cranberrybush, Amur privet.	Washington hawthorn, northern white-cedar, blue spruce, white fir, Austrian pine.	Norway spruce	Eastern white pine, pin oak.
85: Carlow	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
86: Kampville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
91*. Pits					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
2D Goss	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope.	Slight	Moderate: droughty, slope.
2F Goss	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
3 Twomile	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
5C2 Bucklick	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
5D2 Bucklick	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
5E2 Bucklick	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
6C2 Crider	Slight	Slight	Severe: slope.	Slight	Slight.
6D2 Crider	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
6E Crider	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
7B Menfro	Slight	Slight	Moderate: slope.	Slight	Slight.
7C2 Menfro	Slight	Slight	Severe: slope.	Slight	Slight.
7D2 Menfro	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
7E2 Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
7F Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
10F*:					
Gasconade	Severe: large stones, thin layer, slope.	Severe: large stones, thin layer, slope.	Severe: large stones, slope, thin layer.	Severe: large stones, slope.	Severe: large stones, slope, thin layer.
Rock outcrop.					
12 Kennebec	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
16D2: Minnith	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
17F*:					
Ramsey	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, thin layer.
Minnith	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Rock outcrop.					
22F*:					
Goss	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
Gasconade	Severe: large stones, thin layer, slope.	Severe: large stones, thin layer, slope.	Severe: large stones, slope, thin layer.	Severe: large stones, slope.	Severe: large stones, slope, thin layer.
Brussels	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.	Severe: large stones, slope.	Severe: large stones, slope.
24C2: Keswick	Severe: wetness.	Moderate: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
24D2: Keswick	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Severe: erodes easily.	Moderate: wetness, slope.
31B: Hatton	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
31C: Hatton	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Slight	Slight.
33: Haymond	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
34F: Brevator	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
35B: Mexico	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
36: Putnam	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
40: Moniteau	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
43 Cedargap	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
44 Dameron	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
48C Weller	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
61E Crider	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
71D Menfro	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
79 Dupo	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
80 Portage	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
82 Dockery	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
85 Carlow	Severe: flooding, wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.
86 Kampville	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
91*. Pits					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
2D: Goss	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
2F: Goss	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
3: Twomile	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
5C2, 5D2: Bucklick	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
5E2: Bucklick	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
6C2, 6D2: Crider	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
6E: Crider	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
7B: Menfro	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
7C2, 7D2: Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
7E2: Menfro	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
7F: Menfro	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
10F*:										
Gasconade	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
12: Kennebec	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
16D2: Minnith	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
17F*:										
Ramsey	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Minnith	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Rock outcrop.										
22F*:										
Goss	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
22F*:										
Gasconade	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Brussels	Very poor.	Very poor.	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
24C2, 24D2 Keswick	Fair	Good	Fair	Good	Fair	Very poor.	Poor	Fair	Good	Very poor.
31B, 31C Hatton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
33 Haymond	Good	Good	Fair	Good	Good	Poor	Poor	Good	Good	Poor.
34F Brevator	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
35B Mexico	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
36 Putnam	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
40 Moniteau	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
43 Cedargap	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
44 Dameron	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
48C Weller	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Fair	Very poor.
61E Crider	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
71D Menfro	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
79 Dupo	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
80 Portage	Poor	Poor	Poor	Poor	Poor	Poor	Good	Very poor.	Very poor.	Poor.
82 Dockery	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
85 Carlow	Poor	Poor	Fair	Fair	Fair	Poor	Good	Poor	Fair	Fair.
86 Kampville	Fair	Good	Good	Good	Good	Good	Good	Good	Good	Good.
91*. Pits										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2D Goss	Moderate: too clayey, large stones, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: droughty, slope.
2F Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
3 Twomile	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
5C2 Bucklick	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: droughty.
5D2 Bucklick	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: droughty, slope.
5E2 Bucklick	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
6C2 Crider	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope.	Severe: low strength, frost action.	Slight.
6D2 Crider	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
6E Crider	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
7B Menfro	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: frost action, low strength.	Slight.
7C2 Menfro	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
7D2 Menfro	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
7E2, 7F Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
10F*:						
Gasconade	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
Rock outcrop.						
12 Kennebec	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action, low strength.	Moderate: flooding.
16D2 Minnith	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
17F*:						
Ramsey	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
Minnith	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: frost action, low strength, slope.	Severe: slope.
Rock outcrop.						
22F*:						
Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Gasconade	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
Brussels	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: low strength, slope, large stones.	Severe: large stones, slope.
24C2 Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
24D2 Keswick	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
31B Hatton	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
31C Hatton	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
33----------------- Haymond	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
34F---------------- Brevator	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
35B---------------- Mexico	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
36----------------- Putnam	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
40----------------- Moniteau	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
43----------------- Cedargap	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
44----------------- Dameron	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
48C---------------- Weller	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, frost action, low strength.	Slight.
61E---------------- Crider	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
71D---------------- Menfro	Moderate: slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: frost action, low strength.	Moderate: slope.
79----------------- Dupo	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness, shrink-swell.	Severe: flooding.	Severe: low strength, frost action.	Moderate: wetness.
80----------------- Portage	Severe: ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding, too clayey.
82----------------- Dockery	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
85---------------- Carlow	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
86---------------- Kampville	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
91*. Pits						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2D----------------- Goss	Moderate: percs slowly, slope, large stones.	Severe: seepage, slope.	Severe: too clayey, large stones.	Moderate: slope.	Poor: too clayey, small stones.
2F----------------- Goss	Severe: slope.	Severe: seepage, slope.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, small stones, slope.
3------------------ Twomile	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness.	Severe: wetness.	Poor: wetness.
5C2---------------- Bucklick	Moderate: thin layer, seepage, percs slowly.	Severe: slope.	Severe: depth to rock, seepage.	Slight-----------	Poor: too clayey.
5D2---------------- Bucklick	Moderate: thin layer, seepage, percs slowly.	Severe: slope.	Severe: depth to rock, seepage.	Moderate: slope.	Poor: too clayey.
5E2---------------- Bucklick	Severe: slope.	Severe: slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: too clayey, slope.
6C2---------------- Crider	Slight-----------	Severe: slope.	Moderate: too clayey.	Slight-----------	Poor: thin layer.
6D2---------------- Crider	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: thin layer.
6E----------------- Crider	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope, thin layer.
7B----------------- Menfro	Slight-----------	Moderate: slope, seepage.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
7C2---------------- Menfro	Slight-----------	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
7D2---------------- Menfro	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
7E2, 7F------------ Menfro	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10F*:					
Gasconade	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too clayey, large stones.
Rock outcrop.					
12 Kennebec	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
16D2 Minnith	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
17F*:					
Ramsey	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: area reclaim, slope.
Minnith	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Rock outcrop.					
22F*:					
Goss	Severe: slope.	Severe: seepage, slope.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, small stones, slope.
Gasconade	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too clayey, large stones.
Brussels	Severe: percs slowly, slope, large stones.	Severe: slope, large stones.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, large stones, slope.
24C2, 24D2 Keswick	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
31B Hatton	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
31C Hatton	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
33 Haymond	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
34F---------- Brevator	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
35B---------- Mexico	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
36---------- Putnam	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, hard to pack, too clayey.
40---------- Moniteau	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
43---------- Cedargap	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.
44---------- Dameron	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Poor: small stones.
48C---------- Weller	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
61E---------- Crider	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
71D---------- Menfro	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
79---------- Dupo	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
80---------- Portage	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
82---------- Dockery	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
85---------- Carlow	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
86---------- Kampville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
91*. Pits					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
2D------------------- Goss	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
2F------------------- Goss	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
3-------------------- Twomile	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
5C2, 5D2------------- Bucklick	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
5E2------------------ Bucklick	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
6C2------------------ Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
6D2------------------ Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
6E------------------- Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
7B, 7C2-------------- Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
7D2------------------ Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
7E2------------------ Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
7F------------------- Menfro	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
10F*:				
Gasconade------------	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, thin layer.
Rock outcrop.				

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
12------ Kennebec	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
16D2------ Minnith	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
17F*:				
Ramsey------	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Minnith------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rock outcrop.				
22F*:				
Goss------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Gasconade------	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, thin layer.
Brussels------	Poor: low strength, large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: too clayey, large stones, area reclaim.
24C2, 24D2------ Keswick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
31B, 31C------ Hatton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
33------ Haymond	Good------	Improbable: excess fines.	Improbable: excess fines.	Good.
34F------ Brevator	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
35B------ Mexico	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
36------ Putnam	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
40------ Moniteau	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
43 Cedargap	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
44 Dameron	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
48C Weller	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
61E Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
71D Menfro	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope, too clayey.
79 Dupo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
80 Portage	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
82 Dockery	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
85 Carlow	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
86 Kampville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
91*. Pits				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
2D, 2F Goss	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
3 Twomile	Moderate: seepage.	Moderate: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
5C2 Bucklick	Moderate: seepage, depth to rock, slope.	Moderate: thin layer.	Deep to water	Slope, droughty.	Favorable	Droughty.
5D2, 5E2 Bucklick	Severe: slope.	Moderate: thin layer.	Deep to water	Slope, droughty.	Slope	Slope, droughty.
6C2 Crider	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
6D2, 6E Crider	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Slope.
7B, 7C2 Menfro	Moderate: slope, seepage.	Slight	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
7D2, 7E2, 7F Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
10F*:						
Gasconade	Severe: depth to rock, seepage, slope.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
12 Kennebec	Moderate: seepage.	Moderate: thin layer, piping, wetness.	Deep to water	Flooding	Favorable	Favorable.
16D2 Minnith	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
17F*:						
Ramsey	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
Minnith	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Rock outcrop.						

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
22F*:						
Goss	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Gasconade	Severe: depth to rock, seepage, slope.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Brussels	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
24C2 Keswick	Moderate: slope.	Moderate: wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
24D2 Keswick	Severe: slope.	Moderate: wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
31B, 31C Hatton	Moderate: slope.	Moderate: wetness.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Erodes easily, percs slowly.
33 Haymond	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
34F Brevator	Severe: slope.	Severe: hard to pack.	Deep to water	Slope	Slope	Slope.
35B Mexico	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
36 Putnam	Slight	Severe: wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
40 Moniteau	Slight	Severe: wetness.	Frost action	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
43 Cedargap	Severe: seepage.	Severe: seepage.	Deep to water	Flooding	Large stones	Favorable.
44 Dameron	Severe: seepage.	Slight	Deep to water	Flooding	Favorable	Favorable.
48C Weller	Moderate: slope.	Moderate: hard to pack, wetness.	Slope, percs slowly, frost action.	Wetness, percs slowly, slope.	Wetness, erodes easily.	Percs slowly, erodes easily.
61E Crider	Moderate: seepage.	Severe: piping.	Deep to water	Slope	Slope	Slope.
71D Menfro	Severe: slope.	Slight	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
79 Dupo	Moderate: seepage.	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
80 Portage	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly.	Ponding, droughty, slow intake.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, droughty.
82 Dockery	Moderate: seepage.	Moderate: piping, wetness.	Flooding, frost action.	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Erodes easily.
85 Carlow	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness	Erodes easily, wetness, percs slowly.	Wetness, erodes easily.
86 Kampville	Slight	Severe: wetness.	Frost action	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
91*. Pits						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
2D---------------- Goss	0-4	Silt loam--------	ML, CL, CL-ML	A-4	0-5	90-100	75-100	75-95	65-85	20-30	2-10
	4-14	Very cherty silty clay loam, very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	14-60	Cherty silty clay loam, extremely cherty silty clay, extremely cherty clay.	GC	A-7	10-45	45-70	20-65	20-50	20-45	50-70	30-40
2F---------------- Goss	0-7	Cherty silt loam	ML, CL, CL-ML	A-4	0-10	65-85	65-75	65-75	65-75	20-30	2-10
	7-16	Very cherty silty clay loam, very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	16-60	Cherty silty clay loam, extremely cherty silty clay, very cherty clay.	GC	A-7	10-45	45-70	20-65	20-50	20-45	50-70	30-40
3---------------- Twomile	0-18	Silt loam--------	CL-ML, CL	A-4	0	100	100	95-100	90-100	20-30	4-9
	18-29	Silt loam, silt	CL-ML, CL	A-4	0	100	100	95-100	90-100	20-30	4-9
	29-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	90-100	85-95	30-45	15-25
5C2, 5D2--------- Bucklick	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-98	30-45	15-30
	6-56	Silty clay loam, silty clay.	CL	A-7	0-10	95-100	85-100	80-100	75-99	40-50	20-30
	56	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
5E2--------------- Bucklick	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-98	30-45	15-30
	6-43	Silty clay loam, silty clay.	CL	A-7	0-10	95-100	85-100	80-100	75-99	40-50	20-30
	43-50	Very cherty silty clay, cherty silty clay loam, silty clay.	CL, SC, GC	A-7	0-15	70-100	65-100	35-100	35-95	40-50	20-30
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
6C2, 6D2, 6E----- Crider	0-7	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	25-35	4-12
	7-13	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	100	95-100	90-100	85-100	25-42	4-20
	13-60	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0-5	85-100	75-100	70-100	60-100	35-65	15-40
7B, 7C2, 7D2, 7E2, 7F--------- Menfro	0-6	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	25-35	11-20
	6-32	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
	32-60	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-35	5-15

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
10F*:											
Gasconade-------	0-5	Very flaggy silty clay loam.	CL	A-6	50-80	75-90	70-85	60-75	55-65	30-40	15-25
	5-14	Flaggy silty clay, flaggy clay, very flaggy silty clay.	GC	A-2-7	20-70	45-55	40-50	30-40	20-35	55-65	35-45
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
12--------------- Kennebec	0-26	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	90-100	25-45	10-20
	26-60	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	95-100	90-100	25-40	5-15
16D2------------- Minnith	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-90	30-45	10-20
	6-28	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	90-100	85-90	30-50	10-20
	28-60	Clay loam, loam, sandy clay loam.	CL, SC	A-6, A-7	0-5	95-100	90-100	65-95	45-80	30-50	10-30
17F*:											
Ramsey----------	0-6	Loam-------------	SM, CL-ML, ML, SM-SC	A-4, A-2	0-10	85-100	75-95	60-75	30-70	<25	NP-7
	6-12	Loam, sandy loam, fine sandy loam.	SM, CL-ML, ML, SM-SC	A-4, A-2	0-10	85-100	75-95	60-77	30-70	<25	NP-7
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Minnith---------	0-3	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	90-100	90-95	20-35	5-15
	3-28	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	90-100	85-90	30-50	10-20
	28-60	Clay loam, loam, sandy clay loam.	CL, SC	A-6, A-7	0-5	95-100	90-100	65-95	45-80	30-50	10-30
Rock outcrop.											
22F*:											
Goss------------	0-5	Cherty silt loam	ML, CL, CL-ML	A-4	0-10	65-85	65-75	65-75	65-75	20-30	2-10
	5-14	Very cherty silty clay loam, very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	14-60	Very cherty silty clay loam, extremely cherty silty clay, very cherty clay.	GC	A-7	10-45	45-70	20-65	20-50	20-45	50-70	30-40
Gasconade-------	0-4	Very flaggy silty clay loam.	CL	A-6	50-80	75-90	70-85	60-75	55-65	30-40	15-25
	4-13	Flaggy silty clay, flaggy clay, very flaggy silty clay.	GC	A-2-7	20-70	45-55	40-50	30-40	20-35	55-65	35-45
	13	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
22F*:											
Brussels---------	0-5	Very flaggy silty clay loam.	CL	A-6, A-7	45-60	90-100	85-100	75-100	70-95	30-45	15-25
	5-60	Very flaggy silty clay, very flaggy silty clay loam.	CL	A-7	50-80	90-100	85-100	75-100	70-95	40-50	20-30
24C2, 24D2-------- Keswick	0-7	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	75-90	60-80	20-30	5-15
	7-48	Clay loam, clay	CH, MH	A-7	0-5	90-100	80-100	70-90	55-80	50-60	20-30
	48-60	Clay loam--------	CL	A-6	0-5	90-100	80-100	70-90	55-80	30-40	15-25
31B, 31C--------- Hatton	0-14	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	100	100	90-100	80-100	25-40	5-15
	14-32	Silty clay loam, silty clay.	CL, CH	A-7, A-6	0	100	100	95-100	90-100	35-60	20-35
	32-60	Silty clay loam	CL	A-6, A-7	0	100	85-95	80-90	75-85	30-45	15-25
33--------------- Haymond	0-11	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	11-60	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
34F--------------- Brevator	0-5	Loam-------------	CL-ML, CL	A-4, A-6	0-10	85-100	85-100	80-95	60-90	25-35	5-15
	5-13	Cherty loam, cherty silt loam, loam.	CL-ML, CL, GC, SC	A-4, A-6	0-5	65-95	60-90	55-85	45-70	25-35	5-15
	13-60	Clay, clay loam, silty clay.	CL, CH, ML, MH	A-7	0-5	95-100	90-100	90-100	85-95	40-55	15-25
35B-------------- Mexico	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	9-18	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	90-100	45-60	25-35
	18-43	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-75	30-45
	43-60	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	90-100	45-60	25-35
36--------------- Putnam	0-9	Silt loam--------	CL, ML	A-6, A-4	0	100	100	90-100	85-100	30-40	5-15
	9-14	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	85-100	30-40	5-15
	14-40	Silty clay-------	CH	A-7	0	100	100	95-100	90-100	60-70	35-45
	40-50	Silty clay loam, silty clay.	CH	A-7	0	100	100	95-100	90-100	50-65	25-40
	50-60	Silty clay loam	CL	A-7	0	100	100	95-100	90-100	40-50	20-30
40--------------- Moniteau	0-15	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
	15-60	Silty clay loam	CL	A-6, A-7	0	100	100	85-100	80-95	30-45	15-25
43--------------- Cedargap	0-8	Silt loam--------	ML	A-4	0-5	90-100	85-95	75-95	70-95	25-35	3-9
	8-32	Cherty silt loam, cherty loam, very cherty silt loam.	SM, GM	A-1, A-2, A-4	2-15	40-85	20-65	15-45	15-40	25-35	3-9
	32-60	Extremely cherty silty clay loam, extremely cherty clay loam, extremely cherty loam.	GC	A-2-6, A-6	5-20	25-50	20-50	15-45	15-40	30-40	15-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
44-----------------Dameron	0-28	Silt loam--------	CL	A-6	0-1	95-100	90-100	85-100	80-95	25-40	10-20
	28-60	Very cherty silty clay loam, cherty silty clay loam.	GC, SC, CL	A-2-6, A-6	5-15	35-75	25-70	25-70	20-65	30-40	15-25
48C---------------Weller	0-12	Silt loam--------	ML, CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	12-44	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	45-65	30-40
	44-60	Silty clay loam, silt loam.	CH, CL	A-7, A-6	0	100	100	100	95-100	30-55	10-30
61E---------------Crider	0-7	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	25-35	4-12
	7-13	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	100	95-100	90-100	85-100	25-42	4-20
	13-60	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0-5	85-100	75-100	70-100	60-100	35-65	15-40
71D---------------Menfro	0-6	Silt loam--------	CL	A-6	0	100	100	95-100	90-100	25-35	11-20
	6-60	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-45	20-25
79-----------------Dupo	0-8	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-35	1-15
	8-26	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-35	5-15
	26-60	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	100	98-100	35-55	15-30
80-----------------Portage	0-20	Clay-------------	CH	A-7	0	100	100	95-100	90-100	55-80	30-50
	20-60	Clay-------------	CH	A-7	0	100	100	100	95-100	65-85	35-55
82-----------------Dockery	0-10	Silty clay loam	CL	A-6	0	100	100	90-100	85-100	35-40	15-20
	10-60	Stratified silt loam to silty clay loam.	CL	A-4, A-6	0	100	100	90-100	85-95	25-40	8-20
85-----------------Carlow	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	30-45	15-25
	10-60	Silty clay, clay	CL, CH	A-7	0	100	100	95-100	95-100	45-75	30-50
86-----------------Kampville	0-8	Silt loam--------	CL	A-6	0	100	100	90-100	70-90	27-35	10-15
	8-60	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	45-60	30-40
91*. Pits											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
2D----------------- Goss	0-4	10-27	1.20-1.40	2.0-6.0	0.20-0.22	4.5-6.5	Low-----------	0.32	2	6	1-2
	4-14	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low-----------	0.10			
	14-60	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate-----	0.10			
2F----------------- Goss	0-7	10-27	1.10-1.30	2.0-6.0	0.06-0.17	4.5-6.5	Low-----------	0.24	2	8	1-2
	7-16	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low-----------	0.10			
	16-60	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate-----	0.10			
3----------------- Twomile	0-18	10-18	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low-----------	0.43	5	6	1-2
	18-29	10-18	1.40-1.50	0.06-0.6	0.10-0.13	3.6-5.5	Low-----------	0.43			
	29-60	25-35	1.30-1.40	0.06-0.2	0.08-0.10	3.6-6.5	Moderate-----	0.43			
5C2, 5D2---------- Bucklick	0-6	27-35	1.30-1.40	0.6-2.0	0.10-0.20	4.5-7.3	Moderate-----	0.32	3	7	.5-1
	6-56	35-45	1.25-1.35	0.6-2.0	0.10-0.18	4.5-7.3	High----------	0.32			
	56	---	---	---	---	---	-------------	----			
5E2--------------- Bucklick	0-6	27-35	1.30-1.40	0.6-2.0	0.10-0.20	4.5-7.3	Moderate-----	0.32	3	7	.5-1
	6-43	35-45	1.25-1.35	0.6-2.0	0.10-0.18	4.5-7.3	High----------	0.32			
	43-50	35-45	1.25-1.55	0.6-2.0	0.08-0.18	6.1-7.3	High----------	0.32			
	50	---	---	---	---	---	-------------	----			
6C2, 6D2, 6E----- Crider	0-7	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low-----------	0.32	5	6	1-2
	7-13	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low-----------	0.28			
	13-60	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.5	Moderate-----	0.28			
7B, 7C2, 7D2, 7E2, 7F---------- Menfro	0-6	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.37	5	6	.5-2
	6-32	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			
	32-60	8-20	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
10F*:											
Gasconade--------	0-5	35-40	1.35-1.50	0.6-2.0	0.05-0.07	6.1-7.8	Moderate-----	0.20	2	8	2-4
	5-14	35-60	1.45-1.70	0.2-0.6	0.05-0.07	6.1-7.8	Moderate-----	0.20			
	14	---	---	---	---	---	-------------	----			
Rock outcrop.											
12----------------- Kennebec	0-26	22-30	1.25-1.35	0.6-2.0	0.22-0.24	5.6-7.3	Moderate-----	0.32	5	6	5-6
	26-60	24-28	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Moderate-----	0.43			
16D2--------------- Minnith	0-6	27-30	1.30-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Moderate-----	0.37	5	5	1-2
	6-28	25-35	1.30-1.60	0.2-2.0	0.20-0.22	4.5-6.5	Moderate-----	0.37			
	28-60	15-40	1.40-1.60	0.2-0.6	0.16-0.20	4.5-6.5	Moderate-----	0.37			
17F*:											
Ramsey-----------	0-6	8-25	1.25-1.50	6.0-20	0.09-0.12	4.5-5.5	Low-----------	0.24	1	8	.5-1
	6-12	8-25	1.20-1.40	6.0-20	0.09-0.12	4.5-5.5	Low-----------	0.17			
	12	---	---	---	---	---	-------------	----			
Minnith----------	0-3	10-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low-----------	0.37	5	5	1-2
	3-28	25-35	1.30-1.60	0.2-2.0	0.20-0.22	4.5-6.5	Moderate-----	0.37			
	28-60	15-40	1.40-1.60	0.2-0.6	0.16-0.20	4.5-6.5	Moderate-----	0.37			
Rock outcrop.											

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
22F*:											
Goss------------	0-5	10-27	1.10-1.30	2.0-6.0	0.06-0.17	4.5-6.0	Low----------	0.24	2	8	1-2
	5-14	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low----------	0.10			
	14-60	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate-----	0.10			
Gasconade-------	0-4	35-40	1.35-1.50	0.6-2.0	0.05-0.07	6.1-7.8	Moderate-----	0.20	2	8	2-4
	4-13	35-60	1.45-1.70	0.2-0.6	0.05-0.07	6.1-7.8	Moderate-----	0.20			
	13	---	---	---	---	---	-------------	----			
Brussels--------	0-5	27-40	1.30-1.50	0.2-0.6	0.09-0.14	6.1-7.8	Moderate-----	0.15	2	8	2-4
	5-60	35-50	1.35-1.55	0.2-0.6	0.02-0.06	6.1-7.8	Moderate-----	0.20			
24C2, 24D2------- Keswick	0-7	22-27	1.45-1.50	0.6-2.0	0.17-0.22	4.5-7.3	Moderate-----	0.37	3	6	1-2
	7-48	35-48	1.45-1.60	0.06-0.2	0.11-0.15	4.5-6.5	High---------	0.37			
	48-60	30-40	1.60-1.80	0.2-0.6	0.12-0.16	4.5-7.3	Moderate-----	0.37			
31B, 31C--------- Hatton	0-14	12-27	1.35-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.43	4	6	1-2
	14-32	27-48	1.30-1.40	0.06-0.2	0.11-0.18	4.5-5.5	Moderate-----	0.32			
	32-60	27-35	1.45-1.65	<0.06	0.10-0.15	4.5-6.0	Moderate-----	0.43			
33--------------- Haymond	0-11	10-18	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.37	5	5	1-3
	11-60	10-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
34F-------------- Brevator	0-5	20-27	1.30-1.50	0.6-2.0	0.20-0.24	5.1-7.3	Moderate-----	0.32	3	6	.5-2
	5-13	20-27	1.30-1.50	0.6-2.0	0.13-0.18	4.5-6.5	Moderate-----	0.24			
	13-60	35-50	1.30-1.50	0.2-0.6	0.09-0.17	4.5-6.0	High---------	0.24			
35B-------------- Mexico	0-9	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.43	3	6	2-4
	9-18	35-50	1.25-1.45	0.2-0.6	0.12-0.16	4.5-6.0	High---------	0.32			
	18-43	50-60	1.25-1.45	<0.06	0.08-0.12	4.5-6.0	High---------	0.32			
	43-60	35-50	1.25-1.45	0.2-0.6	0.12-0.16	5.1-7.3	High---------	0.32			
36--------------- Putnam	0-9	12-27	1.30-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	3	6	.5-3
	9-14	12-27	1.30-1.50	0.6-2.0	0.20-0.22	4.5-7.3	Low----------	0.43			
	14-40	48-60	1.20-1.40	<0.06	0.09-0.11	3.6-5.5	High---------	0.32			
	40-50	35-48	1.25-1.45	0.06-0.2	0.12-0.16	3.6-5.5	High---------	0.43			
	50-60	27-35	1.30-1.50	0.06-0.2	0.14-0.18	5.1-6.0	Moderate-----	0.43			
40--------------- Moniteau	0-15	18-27	1.20-1.40	0.6-2.0	0.21-0.23	5.1-7.3	Low----------	0.43	3	6	1-2
	15-60	27-35	1.30-1.50	0.2-0.6	0.18-0.20	4.5-6.0	Moderate-----	0.43			
43--------------- Cedargap	0-8	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	6	1-4
	8-32	12-27	1.30-1.50	2.0-6.0	0.10-0.15	5.6-7.3	Low----------	0.24			
	32-60	25-35	1.40-1.55	2.0-6.0	0.04-0.10	5.6-7.3	Low----------	0.10			
44--------------- Dameron	0-28	20-27	1.25-1.40	0.6-2.0	0.22-0.24	6.1-7.3	Low----------	0.32	5	6	2-4
	28-60	27-32	1.40-1.55	2.0-6.0	0.04-0.10	5.6-7.3	Low----------	0.10			
48C-------------- Weller	0-12	16-27	1.35-1.45	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	3	6	1-2
	12-44	28-48	1.35-1.50	0.06-0.2	0.12-0.18	4.5-6.0	High---------	0.43			
	44-60	25-40	1.40-1.55	0.2-0.6	0.18-0.20	5.1-6.0	High---------	0.43			
61E-------------- Crider	0-7	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low----------	0.32	5	6	1-2
	7-13	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low----------	0.28			
	13-60	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.5	Moderate-----	0.28			
71D-------------- Menfro	0-6	18-27	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	.5-2
	6-60	27-33	1.35-1.50	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.37			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
79-----------------Dupo	0-8	10-18	1.25-1.45	0.6-2.0	0.22-0.24	5.6-8.4	Low----------	0.37	5	5	1-2
	8-26	10-18	1.30-1.50	0.6-2.0	0.20-0.22	5.6-8.4	Low----------	0.37			
	26-60	35-45	1.35-1.60	0.06-0.2	0.08-0.19	6.6-7.8	High---------	0.37			
80-----------------Portage	0-20	45-75	1.25-1.45	<0.06	0.12-0.14	5.1-7.3	Very high----	0.37	5	4	2-4
	20-60	60-80	1.30-1.45	<0.06	0.09-0.11	4.5-5.5	Very high----	0.37			
82-----------------Dockery	0-10	27-32	1.35-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Moderate-----	0.37	5	7	2-4
	10-60	18-30	1.35-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Moderate-----	0.37			
85-----------------Carlow	0-10	18-35	1.35-1.50	0.2-0.6	0.21-0.23	5.1-6.0	Moderate-----	0.37	5	7	2-4
	10-60	45-60	1.25-1.35	<0.06	0.09-0.12	4.5-6.0	High---------	0.37			
86-----------------Kampville	0-8	20-27	1.35-1.50	0.6-2.0	0.22-0.24	5.1-6.5	Low----------	0.43	5	6	1-2
	8-60	35-48	1.30-1.45	0.2-0.6	0.18-0.20	4.5-6.0	High---------	0.43			
91*. Pits											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
2D, 2F------------ Goss	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
3----------------- Twomile	C/D	Rare---------	---	---	1.0-2.0	Perched	Nov-May	>60	---	High-----	High-----	High.
5C2, 5D2, 5E2----- Bucklick	C	None---------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Moderate.
6C2, 6D2, 6E------ Crider	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	Moderate.
7B, 7C2, 7D2, 7E2, 7F--------------- Menfro	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
10F*:												
Gasconade--------	D	None---------	---	---	>6.0	---	---	4-20	Hard	Moderate	High-----	Low.
Rock outcrop.												
12---------------- Kennebec	B	Occasional	Brief-----	Nov-May	3.0-5.0	Apparent	Nov-May	>60	---	High-----	Moderate	Low.
16D2-------------- Minnith	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
17F*:												
Ramsey-----------	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	Low------	Moderate.
Minnith----------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Rock outcrop.												

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
22F*:												
Goss	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Gasconade	D	None	---	---	>6.0	---	---	4-20	Hard	Moderate	High	Low.
Brussels	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
24C2, 24D2 Keswick	C	None	---	---	1.0-3.0	Perched	Nov-May	>60	---	High	High	Moderate.
31B, 31C Hatton	C	None	---	---	2.0-3.0	Perched	Nov-May	>60	---	High	High	Moderate.
33 Haymond	B	Occasional	Brief	Nov-May	>6.0	---	---	>60	---	High	Low	Low.
34F Brevator	C	None	---	---	>6.0	---	---	>60	---	High	High	Moderate.
35B Mexico	D	None	---	---	1.0-2.5	Perched	Nov-May	>60	---	Moderate	High	Moderate.
36 Putnam	D	None	---	---	0.5-1.5	Perched	Nov-May	>60	---	Moderate	High	High.
40 Moniteau	C/D	Rare	---	---	0-1.0	Apparent	Nov-May	>60	---	High	High	High.
43 Cedargap	B	Frequent	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Low	Low.
44 Dameron	B	Occasional	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Low	Low.
48C Weller	C	None	---	---	2.0-4.0	Perched	Nov-May	>60	---	High	High	High.
61E Crider	B	None	---	---	>6.0	---	---	>60	---	High	Moderate	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
71D---------------- Menfro	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Low------	Moderate.
79---------------- Dupo	C	Rare---------	---	---	1.5-3.5	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
80---------------- Portage	D	Rare---------	---	---	+.5-1.0	Apparent	Nov-May	>60	---	Moderate	High-----	High.
82---------------- Dockery	C	Frequent----	Brief to long.	Nov-May	2.0-3.0	Apparent	Nov-May	>60	---	High-----	Moderate	Low.
85---------------- Carlow	D	Rare---------	---	---	0-1.0	Apparent	Nov-May	>60	---	Moderate	High-----	Moderate.
86---------------- Kampville	C	Rare---------	---	---	1.0-3.0	Apparent	Nov-May	>60	---	High-----	High-----	High.
91*. Pits												

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Brevator	Fine, montmorillonitic, mesic Typic Hapludalfs
Brussels	Clayey-skeletal, mixed, mesic Typic Hapludolls
Bucklick	Fine, mixed, mesic Typic Hapludalfs
Carlow	Fine, montmorillonitic, mesic Vertic Haplaquolls
Cedargap	Loamy-skeletal, mixed, mesic Cumulic Hapludolls
Crider	Fine-silty, mixed, mesic Typic Paleudalfs
Dameron	Fine-loamy, mixed, mesic Cumulic Hapludolls
Dockery	Fine-silty, mixed, nonacid, mesic Aquic Udifluvents
Dupo	Coarse-silty over clayey, mixed, nonacid, mesic Aquic Udifluvents
Gasconade	Clayey-skeletal, mixed, mesic Lithic Hapludolls
Goss	Clayey-skeletal, mixed, mesic Typic Paleudalfs
Hatton	Fine, montmorillonitic, mesic Typic Hapludalfs
Haymond	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
Kampville	Fine, montmorillonitic, mesic Typic Ochraqualfs
Kennebec	Fine-silty, mixed, mesic Cumulic Hapludolls
Keswick	Fine, montmorillonitic, mesic Aquic Hapludalfs
Menfro	Fine-silty, mixed, mesic Typic Hapludalfs
Mexico	Fine, montmorillonitic, mesic Udollic Ochraqualfs
Minnith	Fine-silty, mixed, mesic Typic Hapludalfs
Moniteau	Fine-silty, mixed, mesic Typic Ochraqualfs
Portage	Very fine, montmorillonitic, mesic Vertic Haplaquolls
Putnam	Fine, montmorillonitic, mesic Mollic Albaqualfs
Ramsey	Loamy, siliceous, mesic Lithic Dystrochrepts
Twomile	Fine-silty, mixed, mesic Typic Albaqualfs
Weller	Fine, montmorillonitic, mesic Aquic Hapludalfs

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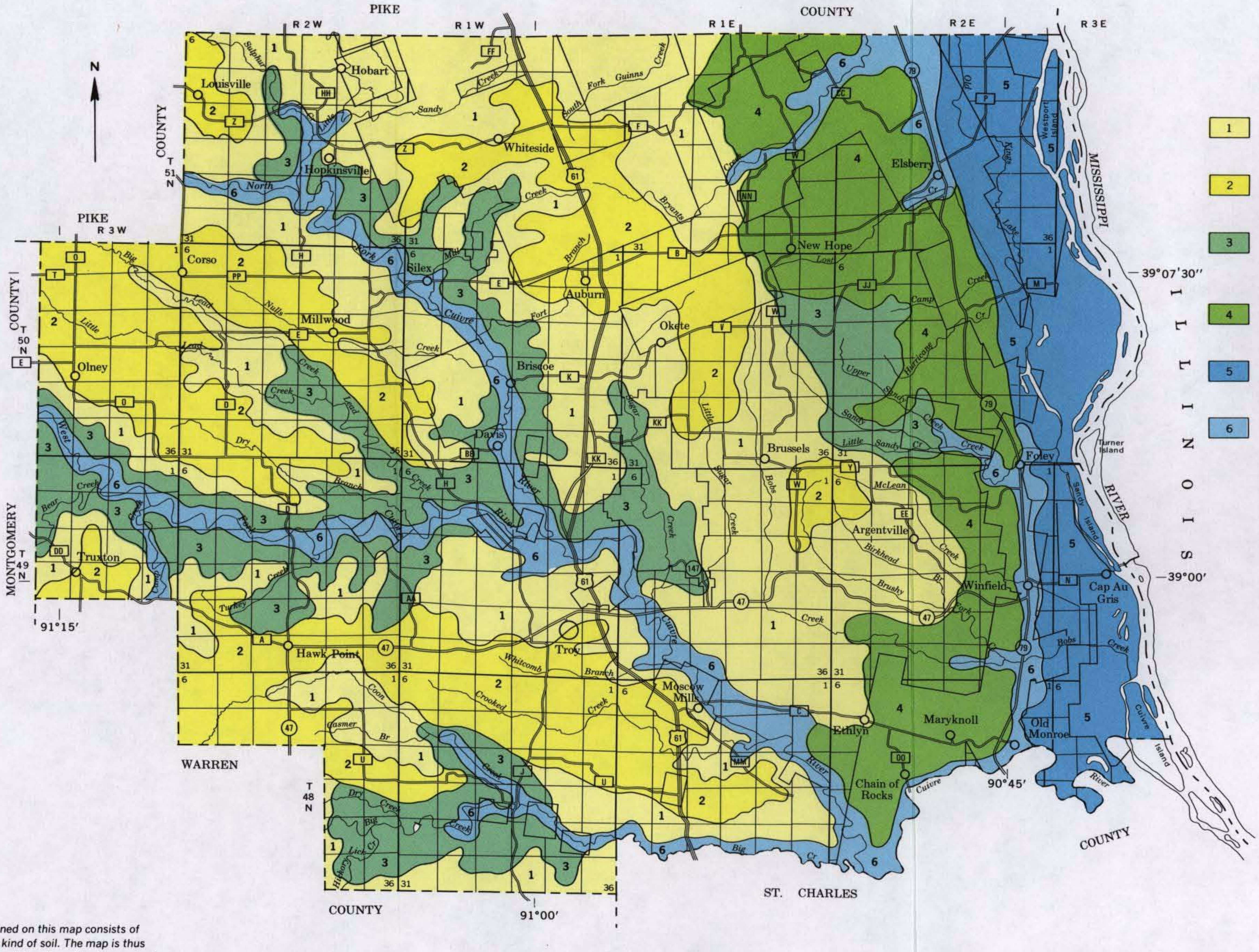


LEGEND

1 — KESWICK-HATTON association: Deep, gently sloping to strongly sloping, moderately well drained soils formed in loess and glacial till; on uplands

2 — MEXICO-KESWICK association: Deep, gently sloping to strongly sloping, somewhat poorly drained and moderately well drained soils formed in loess and in loess and glacial till; on uplands

3 — GOSS-GASCONADE-BRUSSELS association: Deep and shallow, strongly sloping to very steep, well drained and somewhat excessively drained soils formed in cherty dolomite or limestone residuum and in colluvium; on uplands

4 — MENFRO-CRIDER association: Deep, gently sloping to steep, well drained soils formed in loess and in loess and limestone residuum; on uplands

5 — PORTAGE-CARLOW-DOCKERY association: Deep, nearly level, very poorly drained to somewhat poorly drained soils formed in clayey and silty alluvium; on flood plains

6 — HAYMOND-MONITEAU association: Deep, nearly level, well drained and poorly drained soils formed in silty alluvium; on flood plains and stream terraces

COMPILED 1987

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MISSOURI AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

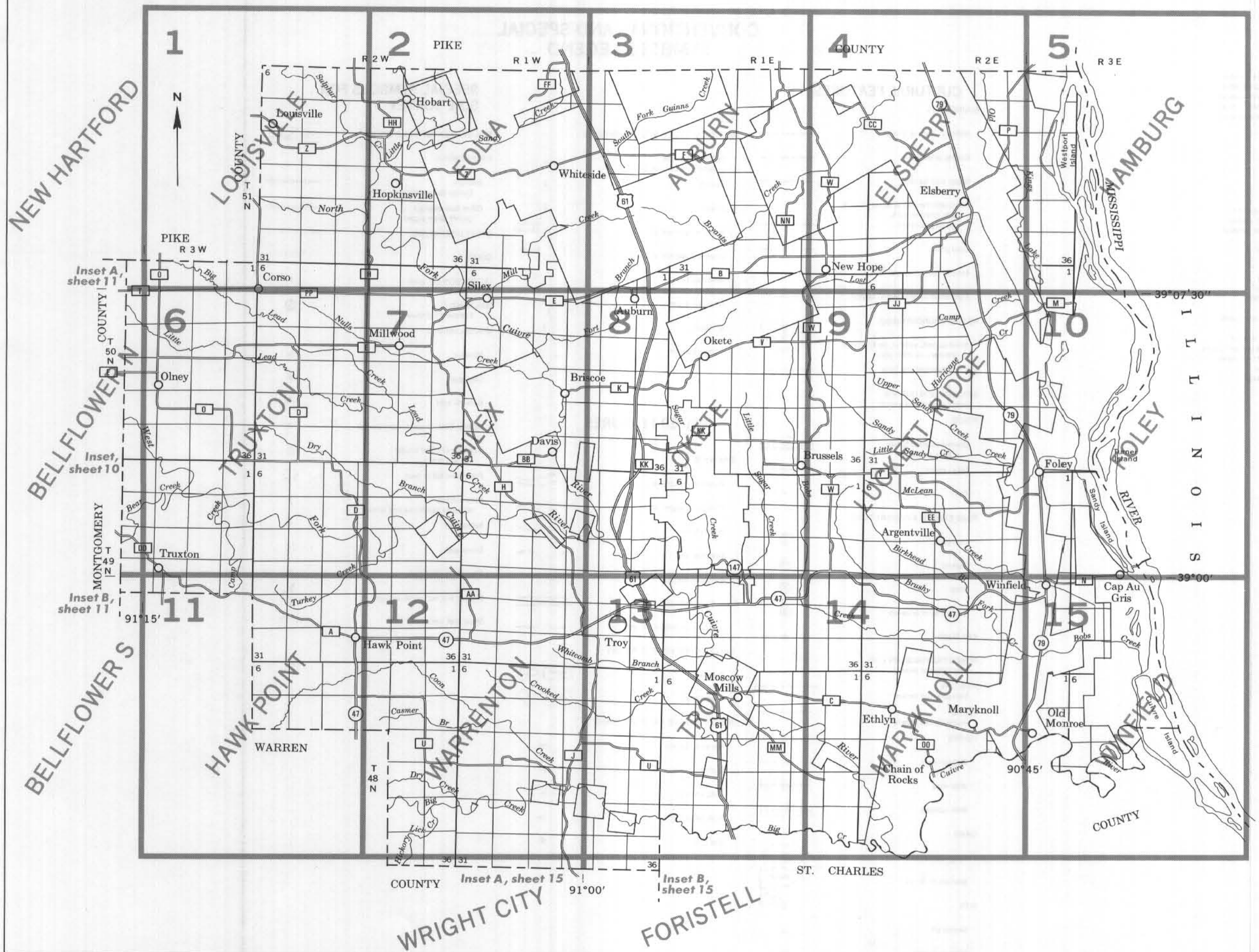
LINCOLN COUNTY, MISSOURI

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

LINCOLN COUNTY, MISSOURI

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 following the slope letter indicates that the soil is eroded.

SYMBOL	NAME
2D	Goss silt loam, 9 to 14 percent slopes
2F	Goss cherty silt loam, 14 to 50 percent slopes
3	Twomile silt loam
5C2	Bucklick silty clay loam, 5 to 9 percent slopes, eroded
5D2	Bucklick silty clay loam, 9 to 14 percent slopes, eroded
5E2	Bucklick silty clay loam, 14 to 20 percent slopes, eroded
6C2	Crider silt loam, 5 to 9 percent slopes, eroded
6D2	Crider silt loam, 9 to 14 percent slopes, eroded
6E	Crider silt loam, 14 to 20 percent slopes
7B	Menfro silt loam, 2 to 5 percent slopes
7C2	Menfro silt loam, 5 to 9 percent slopes, eroded
7D2	Menfro silt loam, 9 to 14 percent slopes, eroded
7E2	Menfro silt loam, 14 to 20 percent slopes, eroded
7F	Menfro silt loam, 20 to 30 percent slopes
10F	Gasconade-Rock outcrop complex, 9 to 70 percent slopes
12	Kennebec silt loam
16D2	Minnith silty clay loam, 9 to 14 percent slopes, eroded
17F	Ramsey-Minnith-Rock outcrop complex, 9 to 65 percent slopes
22F	Goss-Gasconade-Brussels complex, 9 to 70 percent slopes
24C2	Keswick silt loam, 5 to 9 percent slopes, eroded
24D2	Keswick silt loam, 9 to 14 percent slopes, eroded
31B	Hatton silt loam, 2 to 5 percent slopes
31C	Hatton silt loam, 5 to 9 percent slopes
33	Haymond silt loam
34F	Brevator loam, 14 to 30 percent slopes
35B	Mexico silt loam, 1 to 5 percent slopes
36	Putnam silt loam
40	Moniteau silt loam
43	Cedargap silt loam
44	Dameron silt loam
48C	Weller silt loam, 2 to 7 percent slopes
61E	Crider silt loam, karst, 9 to 20 percent slopes
71D	Menfro silt loam, karst, 5 to 14 percent slopes
79	Dupo silt loam
80	Portage clay
82	Dockery silty clay loam
85	Carlow silty clay loam
86	Kampville silt loam
91	Pits, quarries

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label) — Swift Airport

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small — water, w

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 7C2 5D2

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 1
LINCOLN COUNTY, MISSOURI
(LOUISVILLE QUADRANGLE)

This map was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on photography obtained from U.S. Department of Interior, Geological Survey.

5000 4000 3000 2000 1000 0 5000 10000 Feet
1 .5 0 1 2 3 Kilometers
Scale - 1:24 000
LINCOLN COUNTY, MISSOURI NO. 1

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 2
LINCOLN COUNTY, MISSOURI
(EOLIA QUADRANGLE)

R. 2 W. | R. 1 W.

330 000 FEET

91°00'
39°15'

1 240 000 FEET

T. 51 N.
T. 50 N.

T. 51 N.
T. 50 N.

1 200 000 FEET

39°07'30"
91°07'30"

R. 2 W. | R. 1 W.

(Joins sheet 7)

350 000 FEET

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5 000 4 000 3 000 2 000 1 000 0 5 000 10 000 Feet

1 .5 0 1 2 3 Kilometers

Scale - 1:24 000
LINCOLN COUNTY, MISSOURI NO. 2

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SHEET NO. 2 OF 15

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 3
LINCOLN COUNTY, MISSOURI
(AUBURN QUADRANGLE)

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Scale - 1:24 000

LINCOLN COUNTY, MISSOURI NO. 3

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 4
LINCOLN COUNTY, MISSOURI
(ELSBERRY QUADRANGLE)

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1 .5 0 1 2 3 Kilometers
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LINCOLN COUNTY, MISSOURI NO. 4

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 5
LINCOLN COUNTY, MISSOURI
(HAMBURG QUADRANGLE)

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1 .5 0 1 2 3 Kilometers
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LINCOLN COUNTY, MISSOURI NO. 5

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1 .5 0 1 2 3 Kilometers
Scale - 1:24 000
LINCOLN COUNTY, MISSOURI NO. 6

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 7
LINCOLN COUNTY, MISSOURI
(SILEX QUADRANGLE)

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5000 4000 3000 2000 1000 0 5000 10000 Feet
1 .5 0 1 2 3 Kilometers
Scale - 1:24 000
LINCOLN COUNTY, MISSOURI NO. 7

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SOIL CONSERVATION SERVICE

SHEET NUMBER 8
LINCOLN COUNTY, MISSOURI
(OKETE QUADRANGLE)

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5000 4000 3000 2000 1000 0 5000 10000 Feet
1 .5 0 1 2 3 Kilometers
Scale - 1:24000
LINCOLN COUNTY, MISSOURI NO. 8

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 9
LINCOLN COUNTY, MISSOURI
(LUCKETT RIDGE QUADRANGLE)

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1 .5 0 1 2 3 Kilometers
Scale - 1:24 000
LINCOLN COUNTY, MISSOURI NO. 9

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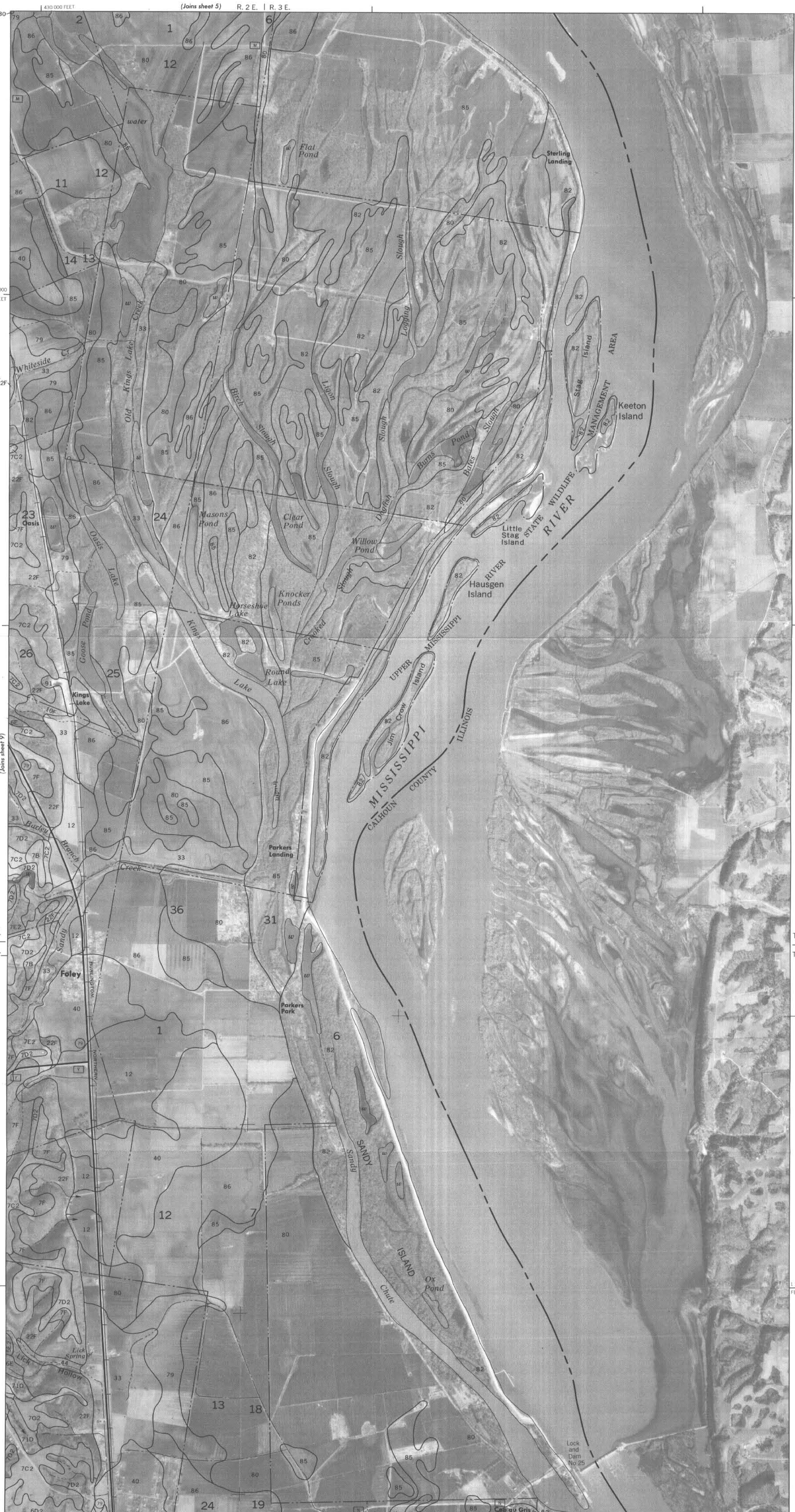
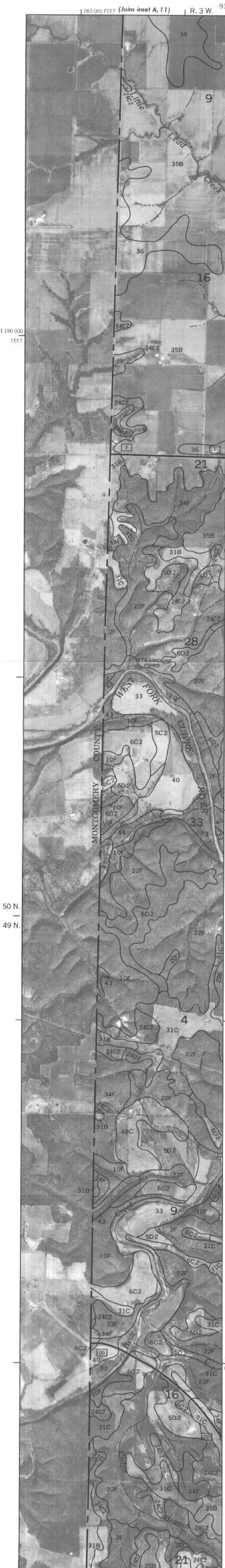
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 10
LINCOLN COUNTY, MISSOURI
(FOLEY QUADRANGLE)





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1 .5 0 1 2 3 Kilometers

Scale - 1:24 000

LINCOLN COUNTY, MISSOURI NO. 10

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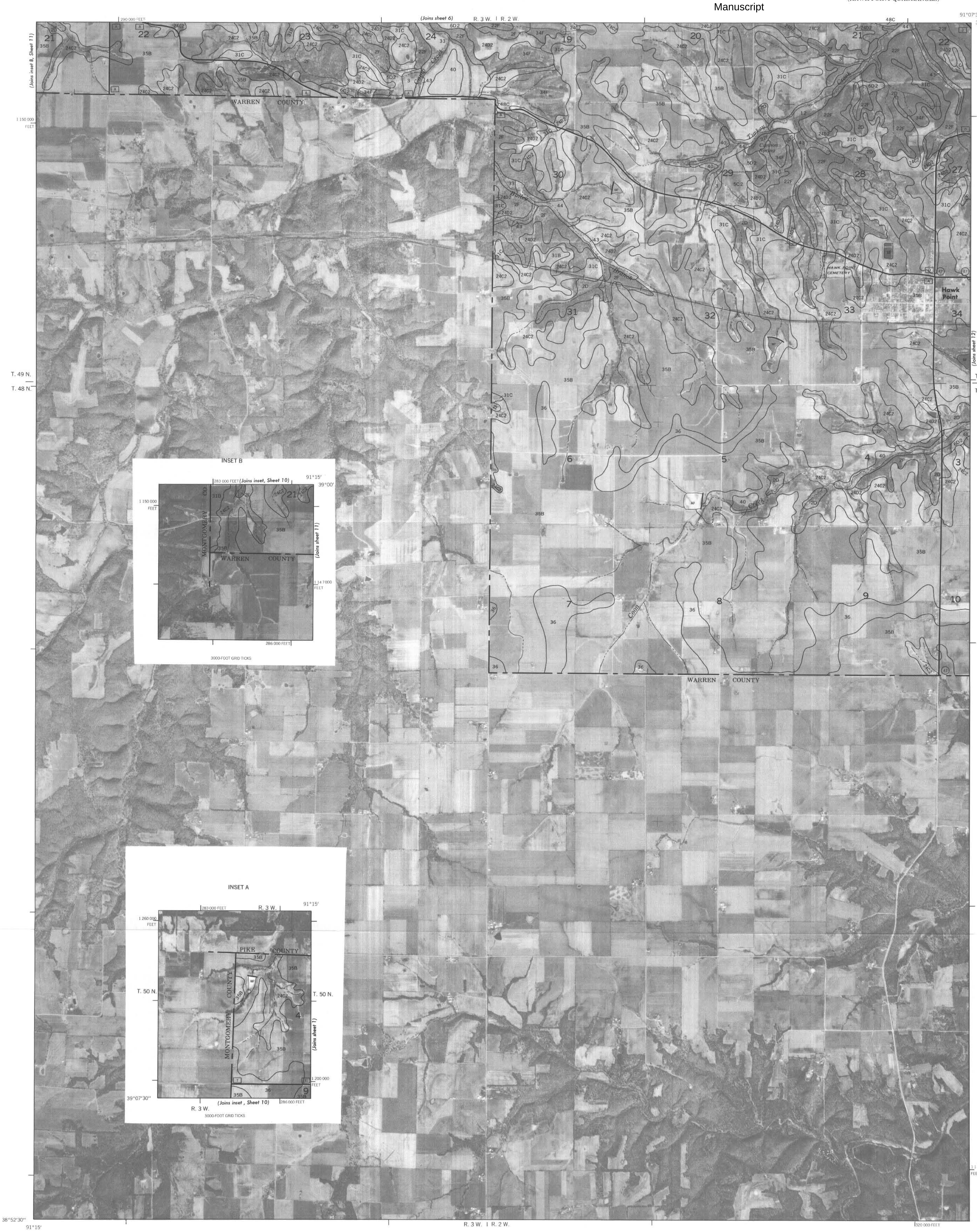
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 11
LINCOLN COUNTY, MISSOURI
(HAWK POINT QUADRANGLE)



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1 .5 0 1 2 3 Kilometers

Scale - 1:24000
LINCOLN COUNTY, MISSOURI NO. 11

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 12
LINCOLN COUNTY, MISSOURI
(WARRENTON NORTHEAST QUADRANGLE)

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1 .5 0 1 2 3 Kilometers
Scale - 1:24000
LINCOLN COUNTY, MISSOURI NO. 12

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 13
LINCOLN COUNTY, MISSOURI
(TROY QUADRANGLE)

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Scale - 1:24 000
5000 4000 3000 2000 1000 0 5000 10000 Feet
1 .5 0 1 2 3 Kilometers

LINCOLN COUNTY, MISSOURI NO. 13

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 14
LINCOLN COUNTY, MISSOURI
(MARYKNOLL QUADRANGLE)

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5000 4000 3000 2000 1000 0 5000 10000 Feet

1 .5 0 1 2 3 Kilometers

Scale 1:24000

LINCOLN COUNTY, MISSOURI NO. 14

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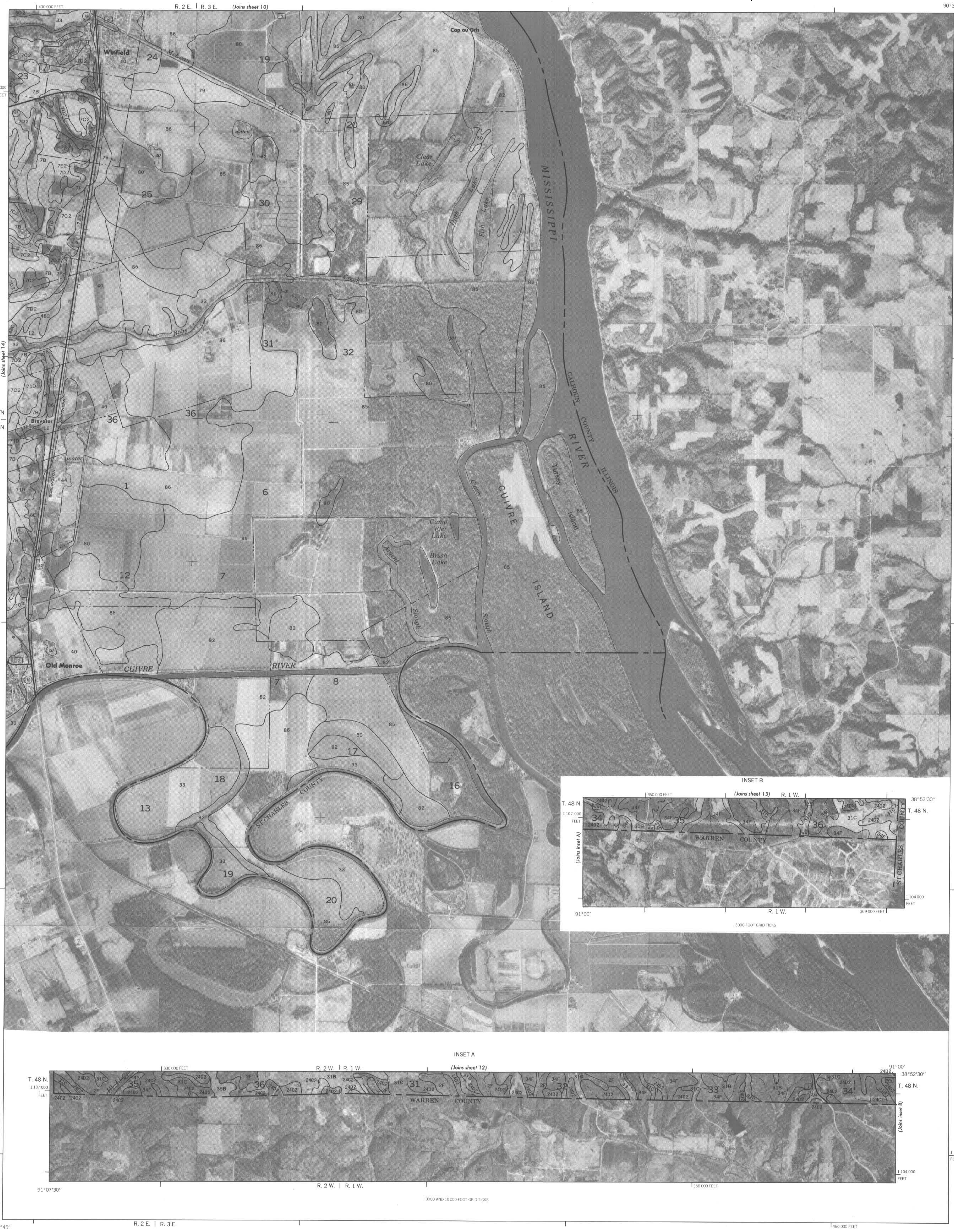
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NUMBER 15
LINCOLN COUNTY, MISSOURI
(WINFIELD QUADRANGLE)



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1 .5 0 1 2 3 Kilometers
Scale - 1:24 000

LINCOLN COUNTY, MISSOURI NO. 15

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